



United States
Department of
Agriculture



Natural
Resources
Conservation
Service

In cooperation with
Oklahoma Agricultural
Experiment Station and
Oklahoma Conservation
Commission

Soil Survey of Canadian County, Oklahoma



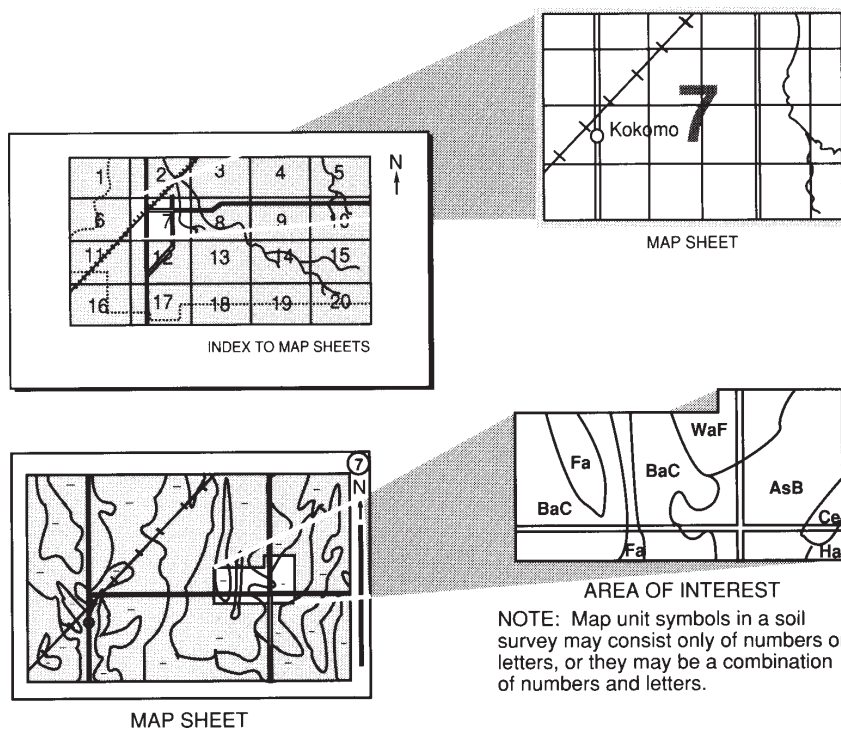
How To Use This Soil Survey

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Note the number of the map sheet and go to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Go to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.



This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1972. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1996. This survey was made cooperatively by the Natural Resources Conservation Service, the Oklahoma Agricultural Experiment Station, and the Oklahoma Conservation Commission. It is part of the technical assistance furnished to the East Canadian County Conservation District, the Central North Canadian River Conservation District, and the North Caddo Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

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Cover: Grass plantings above a farm pond in an area of Grant-Port complex, 0 to 12 percent slopes. Wheat on Bethany silt loam, 0 to 1 percent slopes, is in the background.

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at <http://www.nrcs.usda.gov>.

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Foreword

This soil survey contains information that can be used in land-planning programs in Canadian County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

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Soil Survey of Canadian County, Oklahoma

Original fieldwork by Carl F. Fisher and Bill Swafford, Natural Resources Conservation Service

Update of information by Chuck Sample, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service,
in cooperation with
Oklahoma Agricultural Experiment Station and Oklahoma Conservation Commission

CANADIAN COUNTY is in the central part of Oklahoma (fig. 1). It is bounded on the west by Caddo and Blaine Counties, on the north by Blaine and Kingfisher Counties, on the east by Oklahoma and Cleveland Counties, and on the south by Caddo and Grady Counties. El Reno, the county seat, is in the central part of the county.

The county has an area of 575,360 acres, or 899 square miles. It lies within the Central Rolling Red Prairies Major Land Resource Area. The survey area is dominantly rural, and raising livestock is the main enterprise. Small grain, alfalfa, and grain sorghum are commonly grown.

This publication updates the soil survey of Canadian County, Oklahoma, published in 1976 (4). Because of advancements in technology and more intensive and varied land uses, updated soils information was needed. In preparation of this survey, the Correlation for the Soil Survey of Canadian County, Oklahoma, was amended in May 1996.

This publication is designed to provide updated information and includes the recorrelated map unit legend, general information about the survey area, descriptions of the detailed soil map units and soil series in the county, and a description of how the soils formed. The survey also discusses the use and management of the soils and the major soil properties.

In this survey, the soil map unit names and series names may differ from those in the previous publication, but the map unit symbols have not changed although some new symbols have been added.

Climate

By Billy R. Curry, Climatologist, National Weather Service, United States Department of Commerce, helped prepare this section.

The climate of Canadian County varies from moist and subhumid in the eastern section of the county to dry and subhumid in the central and western sections. In a moist, subhumid climate, the normal annual precipitation exceeds the amount of precipitation required for normal plant growth and development. In a dry subhumid climate, there is a precipitation deficiency and, therefore, a need for some irrigation.

Soil Survey of Canadian County, Oklahoma

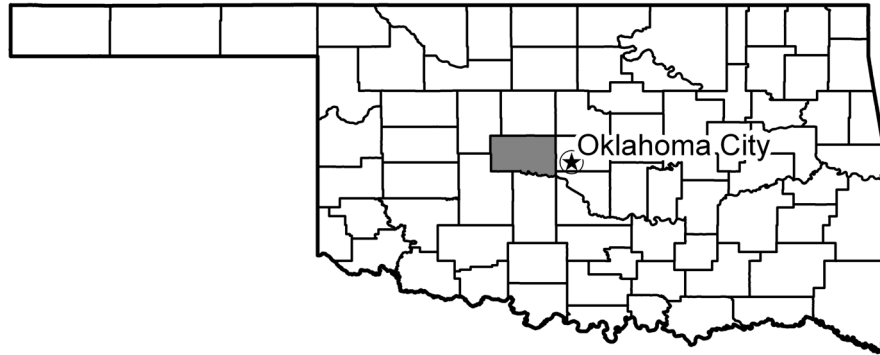


Figure 1.—Location of Canadian County in Oklahoma.

About 78 percent of the normal annual precipitation in Canadian County falls during the crop season (see the table “Temperature and Precipitation”). Most of this precipitation comes from thunderstorms, which frequently produce high-intensity rainfall. Thunderstorms occur on an average of 45 days during a normal 208-day growing season. There are normally 34 days during the growing season when rainfall is 0.10 inch or more, 25 days of 0.25 inch or more, 17 days of 0.50 inch or more, 8 days of 1 inch or more, and 2 days of more than 2 inches. Since 1941, the greatest 24-hour rainfall at El Reno was 7.08 inches, recorded in September 1961. It is estimated that a 24-hour rainfall of 6.05 inches will occur on an average of once every 10 years and that a rainfall of 6.95 inches will occur once every 25 years. A 1-hour rainfall of 2.85 inches is estimated to occur once every 10 years, and a 1-hour rainfall of 3.65 inches once every 25 years.

Summer is normally hot. The average daily maximum temperature during the months of June, July, and August is 92 degrees F. On an average of 20 summer days, the maximum temperature is 100 degrees or higher. The highest recorded temperature at El Reno is 114 degrees, which occurred in August 1936.

The average winter is comparatively mild. A minimum temperature of 32 degrees or below occurs 90 days in a normal year, and there are 7 days in a normal year when freezing temperatures continue throughout the day. Only eight times in the past 20 years have temperatures dropped to zero or below at El Reno. The lowest recorded temperature at El Reno is -15 degrees, which occurred in February 1905.

On average, the last spring freeze at El Reno is on April 8 and the average first fall freeze is on November 2 (see the table “Freeze Dates in Spring and Fall”). Freezing temperatures have occurred as late as May 3 and as early as October 6.

The prevailing wind direction is southerly, but northerly and southerly winds occur with about equal frequency from December to March. The average monthly windspeed varies from 12 miles per hour in July and August to 16 miles per hour in March and April. Strong, gusty winds occur with thunderstorms and with low-pressure systems that migrate from west to east during winter and spring.

The average monthly relative humidity at 6 a.m. is 75 to 80 percent throughout the year. The average monthly relative humidity at 6 p.m. varies from about 45 percent in March, April, July, and August to 60 percent in December and January. With an average of 140 clear days, 98 partly cloudy days, and 127 cloudy days, Canadian County receives 67 percent of the total possible sunshine.

Canadian County, like all of Oklahoma, is susceptible to severe storms. They occur more frequently during hot afternoons in spring but can and have occurred in every month of the year and at every hour of the day. At any one location within the county, hail occurs on 5 days in an average year, although not all of the hailstorms are so intense that they cause damage to crops and property.

Soil Survey of Canadian County, Oklahoma

Temperature and Precipitation (Recorded in the period 1941-70 at El Reno, Oklahoma)

Month	Temperature				Precipitation				
	Average daily		Average monthly		Average monthly total	1 year in 10 will have--		Average number of days with 1.0 inch or more	Average depth of snow on days that have snow
	Maximum temp.	Minimum temp.	Maximum temperature	Minimum temperature		Less than--	More than--		
	°F	°F	°F	°F	In	In	In		In
January-----	49	26	70	6	0.9	0.1	2.3	3	2
February----	54	30	75	12	1.2	0.2	2.1	2	2
March-----	61	36	82	16	1.6	0.5	3.2	1	3
April-----	73	48	89	30	2.9	1.1	6.3	0	0
May-----	81	57	93	41	5.1	1.62	10.4	0	0
June-----	89	66	98	53	3.9	1.3	6.3	0	0
July-----	94	70	102	58	2.6	0.8	5.5	0	0
August-----	94	69	104	56	2.4	0.2	3.9	0	0
September---	86	61	99	46	3.4	0.4	8.2	0	0
October-----	75	50	90	31	2.8	0.3	7.7	0	0
November----	62	37	78	19	1.5	trace	4.3	0	0
December----	52	29	71	10	1.2	0.1	2.7	1	1
Yearly:									
Average----	73	48	---	---	---	---	---	---	---
Extreme----	---	---	105	3	---	---	---	---	---
Total-----	---	---	---	---	29.5	21.1	35.9	7	2

Soil Survey of Canadian County, Oklahoma

Freeze Dates in Spring and Fall

(Data recorded in the period 1921-1968 at El Reno, Oklahoma)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 2	Apr. 14	Apr. 22
2 years in 10 later than--	Mar. 28	Apr. 10	Apr. 17
5 years in 10 later than--	Mar. 18	Apr. 1	Apr. 8
First freezing temperature in fall:			
1 year in 10 earlier than--	Nov. 1	Oct. 23	Oct. 18
2 years in 10 earlier than--	Nov. 8	Oct. 27	Oct. 23
5 years in 10 earlier than--	Nov. 21	Nov. 5	Nov. 2

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, soil scientists develop a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientists to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape (5).

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile (9). After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over

Soil Survey of Canadian County, Oklahoma

long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

Detailed Soil Map Units

The map units on the detailed soil maps represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on the detailed soil maps represents an area on the landscape and consists of one or more soils or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class, there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, are mapped without areas of minor components of other taxonomic classes. Consequently, map units are made up of the soils or miscellaneous areas for which they are named and some areas of included soils that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying layers, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying

layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Kingfisher silt loam, 3 to 5 percent slopes, is a phase of the Kingfisher series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Nash-Ironmound complex, 3 to 8 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Gracemore soils, 0 to 1 percent slopes, frequently flooded, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The Rock outcrop part of Ironmound-Rock outcrop complex, 12 to 30 percent slopes, is an example.

The table "Acreage and Proportionate Extent of the Soils" at the end of this section gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

BeA—Bethany silt loam, 0 to 1 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 950 to 1,250 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 200 to 220 days

Map Unit Composition

Bethany and similar soils: 90 percent

Additional components: 10 percent

Major Component Description

Bethany and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Tread

Parent material: Clayey alluvium

Slope range: 0 to 1 percent

Runoff: Low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Slow

Drainage class: Well drained

Available water capacity: About 10.5 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

Norge and similar soils (5 percent)

Pond Creek and similar soils (5 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 1

Range site number and name: 080AY056OK, Loamy Prairie

BnC—Binger fine sandy loam, 3 to 5 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 800 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Binger and similar soils: 91 percent

Additional components: 9 percent

Major Component Description

Binger and similar soils

Geomorphic setting: Hill on upland

Position on landform: Shoulder and backslope

Parent material: Sandstone

Slope range: 3 to 5 percent

Runoff: Medium

Depth to bedrock (paralithic): 20 to 40 inches

Slowest permeability class within a depth of 60 inches: Moderately slow

Drainage class: Well drained

Available water capacity: About 4.3 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Nash and similar soils (5 percent)
- Quinlan and similar soils (3 percent)
- Wet depressions (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about

managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 3e

Range site number and name: 080AY073OK, Sandy Prairie

Br—Brewer silty clay loam, 0 to 1 percent slopes, rarely flooded

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Brewer and similar soils: 91 percent

Additional components: 9 percent

Major Component Description

Brewer and similar soils

Geomorphic setting: High flood plain on valley

Parent material: Clayey alluvium

Slope range: 0 to 1 percent

Runoff: Low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Slow

Drainage class: Moderately well drained

Available water capacity: About 10.4 inches

Depth to water table: More than 6 feet

Flooding: Rare

Additional Components

- Dale and similar soils (5 percent)
- Watonga and similar soils (3 percent)
- Lebron and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section “Soil Series and Their Morphology.” For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 1

Range site number and name: 080AY045OK, Heavy Bottomland

Bu—Brewer-Drummond complex, 0 to 1 percent slopes, rarely flooded

Map Unit Setting

Major land resource area: 80A
Elevation range: 700 to 1,500 feet
Mean annual precipitation: 26 to 38 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 200 to 230 days

Map Unit Composition

Brewer and similar soils: 60 percent
Drummond and similar soils: 20 percent
Additional components: 20 percent

Major Component Description

Brewer and similar soils

Geomorphic setting: High flood plain on valley
Parent material: Clayey alluvium
Slope range: 0 to 1 percent
Runoff: Low
Soil depth: More than 60 inches
Slowest permeability class within a depth of 60 inches: Slow
Drainage class: Moderately well drained
Available water capacity: About 10.3 inches
Depth to water table: More than 6 feet
Flooding: Rare

Drummond and similar soils

Geomorphic setting: High flood plain on valley
Parent material: Clayey alluvium
Slope range: 0 to 1 percent
Runoff: Low
Soil depth: More than 60 inches
Slowest permeability class within a depth of 60 inches: Very slow
Drainage class: Somewhat poorly drained
Available water capacity: About 6.6 inches
Water table: Present
Flooding: Rare
Salt affected: Saline within a depth of 30 inches
Sodium affected: Sodic within a depth of 30 inches

Additional Components

- Dale and similar soils (10 percent)
- Lebron and similar soils (10 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: Brewer—1; Drummond—6s

Range site number and name: Brewer—080AY050OK, Loamy Bottomland;
Drummond—080AY097OK, Subirrigated (saline)

Ca—Canadian fine sandy loam, 0 to 1 percent slopes, rarely flooded

Map Unit Setting

Major land resource area: 80A

Elevation range: 800 to 1,300 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Canadian and similar soils: 79 percent

Additional components: 21 percent

Major Component Description

Canadian and similar soils

Geomorphic setting: High flood plain on valley

Parent material: Coarse-loamy alluvium

Slope range: 0 to 1 percent

Runoff: Low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderately rapid

Drainage class: Well drained

Available water capacity: About 8.2 inches

Depth to water table: More than 6 feet

Flooding: Rare

Additional Components

- Dale and similar soils (10 percent)
- Minco and similar soils (5 percent)
- Yahola and similar soils (5 percent)
- Lebron and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 1

Range site number and name: 080AY050OK, Loamy Bottomland

Da—Dale silt loam, 0 to 1 percent slopes, rarely flooded

Map Unit Setting

Major land resource area: 80A
Elevation range: 700 to 1,500 feet
Mean annual precipitation: 26 to 38 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 200 to 230 days

Map Unit Composition

Dale and similar soils: 92 percent
Additional components: 8 percent

Major Component Description

Dale and similar soils

Geomorphic setting: High flood plain on valley
Parent material: Fine-silty alluvium
Slope range: 0 to 1 percent
Runoff: Negligible
Soil depth: More than 60 inches
Slowest permeability class within a depth of 60 inches: Moderate
Drainage class: Well drained
Available water capacity: About 11.8 inches
Depth to water table: More than 6 feet
Flooding: Rare

Additional Components

- Canadian and similar soils (4 percent)
- Brewer and similar soils (3 percent)
- Lebron and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 1
Range site number and name: 080AY050OK, Loamy Bottomland

DAM—Large dam

Map Unit Setting

Major land resource area: 80A
Elevation range: 700 to 2,000 feet
Mean annual precipitation: 22 to 40 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 185 to 230 days

Map Unit Composition

Large dam: 100 percent

Major Component Description

Geomorphic setting: Artificial levee

Parent material: Mine spoil or earthy fill

Slope range: 0 to 45 percent

Runoff: Very high

Typical Profile

This map unit has variable material to a depth of 80 inches. The location of a representative area of this unit is about 480 feet north and 1,350 feet west of the southeast corner of sec. 22, T. 13 N., R. 4 W.

Interpretive Groups

Land capability classification: 8

DnD—Darnell-Noble complex, 5 to 15 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 750 to 1,300 feet

Mean annual precipitation: 30 to 40 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Darnell and similar soils: 76 percent

Noble and similar soils: 16 percent

Additional components: 8 percent

Major Component Description

Darnell and similar soils

Geomorphic setting: Hill on upland

Position on landform: Backslope

Parent material: Sandstone

Slope range: 5 to 15 percent

Runoff: High

Depth to bedrock (paralithic): 10 to 20 inches

Slowest permeability class within a depth of 60 inches: Impermeable

Drainage class: Well drained

Available water capacity: About 1.5 inches

Depth to water table: More than 6 feet

Flooding: None

Noble and similar soils

Geomorphic setting: Hill on upland

Position on landform: Footslope

Parent material: Colluvium

Slope range: 5 to 15 percent

Runoff: High

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderately rapid

Drainage class: Well drained

Available water capacity: About 9.2 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Dill and similar soils (4 percent)
- Grandfield and similar soils (4 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major use of this map unit is rangeland.

Interpretive Groups

Land capability classification: 6e

Range site number and name: Darnell—084AY088OK, Shallow Savannah;

Noble—084AY075OK, Sandy Savannah (west)

DnF—Darnell-Noble complex, 15 to 30 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 750 to 1,300 feet

Mean annual precipitation: 30 to 40 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Darnell and similar soils: 66 percent

Noble and similar soils: 15 percent

Additional components: 19 percent

Major Component Description

Darnell and similar soils

Geomorphic setting: Entrenched drainageway on upland

Position on landform: Backslope

Parent material: Sandstone

Slope range: 15 to 30 percent

Runoff: Very high

Depth to bedrock (paralithic): 10 to 20 inches

Slowest permeability class within a depth of 60 inches: Impermeable

Drainage class: Well drained

Available water capacity: About 1.5 inches

Depth to water table: More than 6 feet

Flooding: None

Noble and similar soils

Geomorphic setting: Entrenched drainageway on upland

Position on landform: Footslope

Parent material: Colluvium

Slope range: 15 to 30 percent

Runoff: High

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderately rapid

Drainage class: Well drained

Available water capacity: About 9.2 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Grandfield and similar soils (7 percent)
- Quinlan and similar soils (5 percent)
- Yahola and similar soils (4 percent)
- Minco and similar soils (2 percent)
- Dill and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major use of this map unit is rangeland.

Interpretive Groups

Land capability classification: 7e

Range site number and name: Darnell—084AY088OK, Shallow Savannah;
Noble—084AY075OK, Sandy Savannah (west)

DuD—Dill-Ironmound complex, 5 to 8 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 2,000 feet

Mean annual precipitation: 22 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 185 to 230 days

Map Unit Composition

Dill and similar soils: 60 percent

Ironmound and similar soils: 22 percent

Additional components: 18 percent

Major Component Description

Dill and similar soils

Geomorphic setting: Hill on upland

Position on landform: Shoulder and backslope

Parent material: Sandstone

Slope range: 5 to 8 percent

Runoff: High

Depth to bedrock (paralithic): 20 to 40 inches

Slowest permeability class within a depth of 60 inches: Moderately slow

Drainage class: Well drained
Available water capacity: About 3.9 inches
Depth to water table: More than 6 feet
Flooding: None

Ironmound and similar soils

Geomorphic setting: Hill on upland
Position on landform: Backslope
Parent material: Sandstone
Slope range: 5 to 8 percent
Runoff: Very high
Depth to bedrock (paralithic): 10 to 20 inches
Slowest permeability class within a depth of 60 inches: Impermeable
Drainage class: Well drained
Available water capacity: About 1.7 inches
Depth to water table: More than 6 feet
Flooding: None

Additional Components

- Grant and similar soils (10 percent)
- Nashville and similar soils (8 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major use of this map unit is rangeland.

Interpretive Groups

Land capability classification: 4e
Range site number and name: Dill—078CY073OK, Sandy Prairie; Ironmound—080AY083OK, Shallow Prairie

DUM—Dumps

Map Unit Setting

Major land resource area: 80A
Elevation range: 900 to 1,200 feet
Mean annual precipitation: 32 to 36 inches
Mean annual air temperature: 60 to 61 degrees F
Frost-free period: 200 to 210 days

Map Unit Composition

Dumps: 100 percent

Major Component Description

Geomorphic setting: Dump
Parent material: Mine spoil or earthy fill
Slope range: 0 to 50 percent
Runoff: Very high

Typical Profile

This map unit consists of trash dumps that include household refuse, tree and grass trimmings, old tires, and other trash. The material is variable to a depth of 80 inches. The location of a representative area of this unit is about 200 feet west and 3,600 feet north of the southeast corner of sec. 1, T. 16 N., R. 3 W.

Interpretive Groups

Land capability classification: 8

Ga—Gracemore loamy fine sand, 0 to 1 percent slopes, occasionally flooded

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,300 feet

Mean annual precipitation: 24 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Gracemore and similar soils: 86 percent

Additional components: 14 percent

Major Component Description

Gracemore and similar soils

Geomorphic setting: Low flood plain on valley

Parent material: Sandy alluvium

Slope range: 0 to 1 percent

Runoff: Negligible

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderately rapid

Drainage class: Somewhat poorly drained

Available water capacity: About 4.4 inches

Water table: Present

Flooding: Occasional

Additional Components

- Yahola and similar soils (8 percent)
- Gaddy and similar soils (5 percent)
- Ezell and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major use of this map unit is rangeland.

Interpretive Groups

Land capability classification: 3w

Range site number and name: 080AY095OK, Subirrigated

Gb—Gracemore soils, 0 to 1 percent slopes, frequently flooded

Map Unit Setting

Major land resource area: 80A
Elevation range: 700 to 1,300 feet
Mean annual precipitation: 24 to 38 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 190 to 230 days

Map Unit Composition

Gracemore and similar soils: 84 percent
Additional components: 16 percent

Major Component Description

Gracemore and similar soils

Geomorphic setting: Low flood plain on valley
Parent material: Sandy alluvium
Slope range: 0 to 1 percent
Runoff: Negligible
Soil depth: More than 60 inches
Slowest permeability class within a depth of 60 inches: Moderately rapid
Drainage class: Somewhat poorly drained
Available water capacity: About 4.3 inches
Water table: Present
Flooding: Frequent

Additional Components

- Yahola and similar soils (8 percent)
- Gaddy and similar soils (5 percent)
- Ezell and similar soils (3 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major use of this map unit is rangeland.

Interpretive Groups

Land capability classification: 5w
Range site number and name: 080AY095OK, Subirrigated

GdB—Konawa fine sandy loam, 1 to 3 percent slopes

Map Unit Setting

Major land resource area: 80A
Elevation range: 500 to 1,500 feet
Mean annual precipitation: 30 to 38 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 200 to 230 days

Map Unit Composition

Konawa and similar soils: 92 percent

Additional components: 8 percent

Major Component Description

Konawa and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Summit and shoulder

Parent material: Eolian deposits

Slope range: 1 to 3 percent

Runoff: Negligible

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 8.8 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Minco and similar soils (5 percent)
- Darnell and similar soils (3 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 2e

Range site number and name: 084AY076OK, Sandy Savannah (central)

GdC—Konawa fine sandy loam, 3 to 5 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 500 to 1,500 feet

Mean annual precipitation: 30 to 38 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Konawa and similar soils: 90 percent

Additional components: 10 percent

Major Component Description

Konawa and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Backslope

Parent material: Eolian deposits

Slope range: 3 to 5 percent

Runoff: Very low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 8.8 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Noble and similar soils (8 percent)
- Darnell and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section “Soil Series and Their Morphology.” For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 3e

Range site number and name: 084AY076OK, Sandy Savannah (central)

GdC2—Konawa fine sandy loam, 3 to 5 percent slopes, eroded

Map Unit Setting

Major land resource area: 80A

Elevation range: 500 to 1,500 feet

Mean annual precipitation: 30 to 38 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Konawa and similar soils: 88 percent

Additional components: 12 percent

Major Component Description

Konawa and similar soils

Extent of the component in the map unit: 88 percent

Geomorphic setting: Terrace on upland

Position on landform: Backslope

Parent material: Eolian deposits

Slope range: 3 to 5 percent

Runoff: Very low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 8.8 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Noble and similar soils (6 percent)
- Minco and similar soils (4 percent)
- Darnell and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section “Soil Series and Their Morphology.” For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 3e

Range site number and name: 084AY876OK, Reseeded Sandy Savannah

GdD—Konawa fine sandy loam, 5 to 8 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 500 to 1,500 feet

Mean annual precipitation: 30 to 38 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Konawa and similar soils: 88 percent

Additional components: 12 percent

Major Component Description

Konawa and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Backslope

Parent material: Eolian deposits

Slope range: 5 to 8 percent

Runoff: Low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 8.8 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Noble and similar soils (6 percent)
- Minco and similar soils (4 percent)
- Darnell and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section “Soil Series and Their Morphology.” For general and detailed information about

managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 4e

Range site number and name: 084AY076OK, Sandy Savannah (central)

GdD3—Konawa soils, 3 to 8 percent slopes, severely eroded

Map Unit Setting

Major land resource area: 80A

Elevation range: 500 to 1,500 feet

Mean annual precipitation: 30 to 38 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Konawa and similar soils: 90 percent

Additional components: 10 percent

Major Component Description

Konawa and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Backslope

Parent material: Eolian deposits

Slope range: 3 to 8 percent

Runoff: Low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 8.7 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Noble and similar soils (6 percent)
- Minco and similar soils (4 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section “Soil Series and Their Morphology.” For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major use of this map unit is pasture.

Interpretive Groups

Land capability classification: 6e

Range site number and name: 084AY876OK, Reseeded Sandy Savannah

GhB—Grant-Pawhuska complex, 1 to 3 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Grant and similar soils: 50 percent

Pawhuska and similar soils: 35 percent

Additional components: 15 percent

Major Component Description

Grant and similar soils

Geomorphic setting: Dissected terrace on upland

Position on landform: Summit and backslope

Parent material: Sandstone

Slope range: 1 to 3 percent

Runoff: Very low

Depth to bedrock (paralithic): 40 to 60 inches

Slowest permeability class within a depth of 60 inches: Very slow

Drainage class: Well drained

Available water capacity: About 9.0 inches

Depth to water table: More than 6 feet

Flooding: None

Pawhuska and similar soils

Geomorphic setting: Dissected terrace on upland

Position on landform: Summit and backslope

Parent material: Sandstone

Slope range: 1 to 3 percent

Runoff: High

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Very slow

Drainage class: Moderately well drained

Available water capacity: About 7.8 inches

Depth to water table: More than 6 feet

Flooding: None

Salt affected: Saline within a depth of 30 inches

Sodium affected: Sodic within a depth of 30 inches

Additional Components

- Kingfisher and similar soils (8 percent)
- Lucien and similar soils (7 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: Grant—2e; Pawhuska—4s

Range site number and name: Grant—080AY056OK, Loamy Prairie; Pawhuska—080AY091OK, Slickspot

GpE—Grant-Port complex, 0 to 12 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Grant and similar soils: 50 percent

Port and similar soils: 30 percent

Additional components: 20 percent

Major Component Description

Grant and similar soils

Geomorphic setting: Dissected terrace on upland

Position on landform: Backslope

Parent material: Sandstone

Slope range: 3 to 12 percent

Runoff: Medium

Depth to bedrock (paralithic): 40 to 60 inches

Slowest permeability class within a depth of 60 inches: Very slow

Drainage class: Well drained

Available water capacity: About 9.0 inches

Depth to water table: More than 6 feet

Flooding: None

Port and similar soils

Geomorphic setting: Low flood plain on valley

Parent material: Fine-silty alluvium

Slope range: 0 to 1 percent

Runoff: Very low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 11.8 inches

Depth to water table: More than 6 feet

Flooding: Frequent

Additional Components

- Kingfisher and similar soils (5 percent)
- Dill and similar soils (4 percent)
- Lucien and similar soils (4 percent)
- Norge and similar soils (2 percent)
- Renfrow and similar soils (3 percent)

- Nash and similar soils (1 percent)
- Pond Creek and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section “Soil Series and Their Morphology.” For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major use of this map unit is rangeland.

Interpretive Groups

Land capability classification: Grant—6e; Port—5w

Range site number and name: Grant—080AY056OK, Loamy Prairie; Port—080AY050OK, Loamy Bottomland

GuD—Grant-Ironmound complex, 5 to 8 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Grant and similar soils: 68 percent

Ironmound and similar soils: 16 percent

Additional components: 16 percent

Major Component Description

Grant and similar soils

Geomorphic setting: Dissected terrace on upland

Position on landform: Backslope

Parent material: Sandstone

Slope range: 5 to 8 percent

Runoff: Medium

Depth to bedrock (paralithic): 40 to 60 inches

Slowest permeability class within a depth of 60 inches: Very slow

Drainage class: Well drained

Available water capacity: About 9.0 inches

Depth to water table: More than 6 feet

Flooding: None

Ironmound and similar soils

Geomorphic setting: Hill on upland

Position on landform: Backslope

Parent material: Sandstone

Slope range: 5 to 8 percent

Runoff: Very high

Depth to bedrock (paralithic): 10 to 20 inches

Slowest permeability class within a depth of 60 inches: Impermeable

Drainage class: Well drained

Available water capacity: About 2.0 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Norge and similar soils (10 percent)
- Minco and similar soils (4 percent)
- Piedmont and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 4e

Range site number and name: Grant—080AY056OK, Loamy Prairie; Ironmound—080AY083OK, Shallow Prairie

GuD2—Grant-Ironmound complex, 3 to 8 percent slopes, eroded

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Grant and similar soils: 50 percent

Ironmound and similar soils: 30 percent

Additional components: 20 percent

Major Component Description

Grant and similar soils

Geomorphic setting: Dissected terrace on upland

Position on landform: Shoulder and backslope

Parent material: Sandstone

Slope range: 3 to 8 percent

Runoff: Medium

Depth to bedrock (paralithic): 40 to 60 inches

Slowest permeability class within a depth of 60 inches: Very slow

Drainage class: Well drained

Available water capacity: About 9.0 inches

Depth to water table: More than 6 feet

Flooding: None

Ironmound and similar soils

Geomorphic setting: Hill on upland

Position on landform: Backslope

Parent material: Sandstone

Slope range: 3 to 8 percent

Runoff: Very high

Depth to bedrock (paralithic): 10 to 20 inches

Slowest permeability class within a depth of 60 inches: Impermeable

Drainage class: Well drained

Available water capacity: About 2.0 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Norge and similar soils (10 percent)
- Minco and similar soils (6 percent)
- Piedmont and similar soils (4 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 4e

Range site number and name: Grant—080AY856OK, Reseeded Loamy Prairie;

Ironmound—080AY883OK, Reseeded Shallow Prairie

KfB—Kingfisher silt loam, 1 to 3 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Kingfisher and similar soils: 87 percent

Additional components: 13 percent

Major Component Description

Kingfisher and similar soils

Geomorphic setting: Hill on upland

Position on landform: Summit and backslope

Parent material: Sandstone

Slope range: 1 to 3 percent

Runoff: Medium

Depth to bedrock (paralithic): 20 to 40 inches

Slowest permeability class within a depth of 60 inches: Impermeable

Drainage class: Well drained

Available water capacity: About 5.8 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Norge and similar soils (7 percent)
- Renfrow and similar soils (5 percent)
- Wakita and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 2e

Range site number and name: 080AY056OK, Loamy Prairie

KfC—Kingfisher silt loam, 3 to 5 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Kingfisher and similar soils: 87 percent

Additional components: 13 percent

Major Component Description

Kingfisher and similar soils

Geomorphic setting: Hill on upland

Position on landform: Shoulder and backslope

Parent material: Sandstone

Slope range: 3 to 5 percent

Runoff: Medium

Depth to bedrock (paralithic): 20 to 40 inches

Slowest permeability class within a depth of 60 inches: Impermeable

Drainage class: Well drained

Available water capacity: About 5.8 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Norge and similar soils (7 percent)
- Renfrow and similar soils (5 percent)
- Grainola and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about



Figure 2.—Rangeland on Kingfisher silt loam, 3 to 5 percent slopes.

managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major uses of this map unit are cropland and rangeland (fig. 2).

Interpretive Groups

Land capability classification: 3e

Range site number and name: 080AY056OK, Loamy Prairie

KrA—Kirkland silt loam, 0 to 1 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 1,000 to 1,300 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Kirkland and similar soils: 95 percent

Additional components: 5 percent

Major Component Description

Kirkland and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Tread

Parent material: Clayey alluvium over shale

Slope range: 0 to 1 percent

Runoff: Medium

Depth to bedrock (paralithic): 60 to 99 inches

Slowest permeability class within a depth of 60 inches: Impermeable

Drainage class: Well drained

Available water capacity: About 8.4 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Norge and similar soils (3 percent)
- Piedmont and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section “Soil Series and Their Morphology.” For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major uses of this map unit are cropland and rangeland (fig. 3).



Figure 3.—Wheat on Kirkland silt loam, 0 to 1 percent slopes.

Interpretive Groups

Land capability classification: 2s

Range site number and name: 080AY010OK, Claypan Prairie (north)

KrB—Kirkland silt loam, 1 to 3 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 1,000 to 1,300 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Kirkland and similar soils: 95 percent

Additional components: 5 percent

Major Component Description

Kirkland and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Tread

Parent material: Clayey alluvium over shale

Slope range: 1 to 3 percent

Runoff: High

Depth to bedrock (paralithic): 60 to 99 inches

Slowest permeability class within a depth of 60 inches: Impermeable

Drainage class: Well drained

Available water capacity: About 8.4 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Norge and similar soils (3 percent)
- Piedmont and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 3e

Range site number and name: 080AY010OK, Claypan Prairie (north)

KsB—Kirkland-Pawhuska complex, 1 to 3 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Kirkland and similar soils: 50 percent

Pawhuska and similar soils: 35 percent

Additional components: 15 percent

Major Component Description

Kirkland and similar soils

Geomorphic setting: Dissected terrace on upland

Position on landform: Summit and shoulder

Parent material: Clayey alluvium over shale

Slope range: 1 to 3 percent

Runoff: High

Depth to bedrock (paralithic): 60 to 99 inches

Slowest permeability class within a depth of 60 inches: Impermeable

Drainage class: Well drained

Available water capacity: About 8.4 inches

Depth to water table: More than 6 feet

Flooding: None

Pawhuska and similar soils

Geomorphic setting: Dissected terrace on upland

Position on landform: Summit and shoulder

Parent material: Sandstone-shale

Slope range: 1 to 3 percent

Runoff: High

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Very slow

Drainage class: Moderately well drained

Available water capacity: About 7.8 inches

Depth to water table: More than 6 feet

Flooding: None

Salt affected: Saline within a depth of 30 inches

Sodium affected: Sodic within a depth of 30 inches

Additional Components

- Norge and similar soils (9 percent)
- Piedmont and similar soils (6 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and pasture.

Interpretive Groups

Land capability classification: Kirkland—3e; Pawhuska—4s

Range site number and name: Kirkland—080AY010OK, Claypan Prairie (north);
Pawhuska—080AY091OK, Slickspot

KwD—Konawa loamy fine sand, 3 to 8 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 500 to 1,500 feet

Mean annual precipitation: 30 to 38 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Konawa and similar soils: 90 percent

Additional components: 10 percent

Major Component Description

Konawa and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Backslope

Parent material: Eolian deposits

Slope range: 3 to 8 percent

Runoff: Medium

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 7.9 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Dougherty and similar soils (9 percent)
- Carwile and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses for this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 4e

Range site number and name: 084AY018OK, Deep Sand Savannah

M-W—Miscellaneous water

Map Unit Setting

Major land resource area: 80A

Elevation range: 250 to 4,000 feet

Mean annual precipitation: 22 to 48 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 190 to 240 days

Map Unit Composition

Water: 100 percent

Major Component Description

Geomorphic setting: Sewage lagoon

Typical Profile

This map unit includes sewage lagoons and industrial waste water. The location of a representative area of this unit is about 1,150 feet north and 475 feet west of the southeast corner of sec. 2, T. 12 N., R. 2 W.

Interpretive Groups

Land capability classification: 8

Mc—McLain silty clay loam, 0 to 1 percent slopes, rarely flooded

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

McLain and similar soils: 91 percent

Additional components: 9 percent

Major Component Description

McLain and similar soils

Geomorphic setting: High flood plain on valley

Parent material: Clayey alluvium

Slope range: 0 to 1 percent

Runoff: Low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Slow

Drainage class: Moderately well drained

Available water capacity: About 10.5 inches

Depth to water table: More than 6 feet

Flooding: Rare

Additional Components

- Dale and similar soils (5 percent)
- Watonga and similar soils (3 percent)
- Ustibuck and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 1

Range site number and name: 080AY045OK, Heavy Bottomland

MnD—Minco very fine sandy loam, 5 to 8 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Minco and similar soils: 90 percent

Additional components: 10 percent

Major Component Description

Minco and similar soils

Geomorphic setting: Stream terrace on valley

Position on landform: Riser

Parent material: Eolian deposits

Slope range: 5 to 8 percent

Runoff: Medium

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 11.1 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Konawa and similar soils (5 percent)
- Slaughterville and similar soils (5 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 4e

Range site number and name: 080AY056OK, Loamy Prairie

MnF—Minco very fine sandy loam, 8 to 30 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 200 to 230 days

Map Unit Composition

Minco and similar soils: 89 percent
Additional components: 11 percent

Major Component Description

Minco and similar soils

Geomorphic setting: Stream terrace on valley
Position on landform: Riser
Parent material: Eolian deposits
Slope range: 8 to 30 percent
Runoff: High
Soil depth: More than 60 inches
Slowest permeability class within a depth of 60 inches: Moderate
Drainage class: Well drained
Available water capacity: About 11.1 inches
Depth to water table: More than 6 feet
Flooding: None

Additional Components

- Slaughterville and similar soils (5 percent)
- Wisby and similar soils (3 percent)
- Ironmound and similar soils (2 percent)
- Seep springs (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major use of this map unit is rangeland.

Interpretive Groups

Land capability classification: 6e
Range site number and name: 080AY056OK, Loamy Prairie

MsB—Minco silt loam, 1 to 3 percent slopes

Map Unit Setting

Major land resource area: 80A
Elevation range: 700 to 1,500 feet
Mean annual precipitation: 26 to 38 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 200 to 230 days

Map Unit Composition

Minco and similar soils: 90 percent
Additional components: 10 percent

Major Component Description

Minco and similar soils

Geomorphic setting: Stream terrace on upland

Position on landform: Tread and riser

Parent material: Eolian deposits

Slope range: 1 to 3 percent

Runoff: Very low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 11.1 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Grant and similar soils (5 percent)
- Pond Creek and similar soils (5 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 2e

Range site number and name: 080AY056OK, Loamy Prairie

MsC—Minco silt loam, 3 to 5 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Minco and similar soils: 88 percent

Additional components: 12 percent

Major Component Description

Minco and similar soils

Geomorphic setting: Stream terrace on valley

Position on landform: Riser

Parent material: Eolian deposits

Slope range: 3 to 5 percent

Runoff: Low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 11.1 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Slaughterville and similar soils (10 percent)
- Konawa and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 3e

Range site number and name: 080AY056OK, Loamy Prairie

NaD—Nash-Ironmound complex, 3 to 8 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Nash and similar soils: 78 percent

Ironmound and similar soils: 16 percent

Additional components: 6 percent

Major Component Description

Nash and similar soils

Geomorphic setting: Hill on upland

Position on landform: Backslope

Parent material: Sandstone

Slope range: 3 to 8 percent

Runoff: High

Depth to bedrock (paralithic): 20 to 40 inches

Slowest permeability class within a depth of 60 inches: Moderately slow

Drainage class: Well drained

Available water capacity: About 5.8 inches

Depth to water table: More than 6 feet

Flooding: None

Ironmound and similar soils

Geomorphic setting: Hill on upland

Position on landform: Backslope

Parent material: Sandstone

Slope range: 3 to 8 percent

Runoff: Very high

Depth to bedrock (paralithic): 10 to 20 inches
Slowest permeability class within a depth of 60 inches: Impermeable
Drainage class: Well drained
Available water capacity: About 1.7 inches
Depth to water table: More than 6 feet
Flooding: None

Additional Components

- Kingfisher and similar soils (4 percent)
- Norge and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 4e
Range site number and name: Nash—080AY056OK, Loamy Prairie; Ironmound—080AY083OK, Shallow Prairie

NaD2—Nash-Ironmound complex, 3 to 8 percent slopes, eroded

Map Unit Setting

Major land resource area: 80A
Elevation range: 700 to 1,500 feet
Mean annual precipitation: 26 to 38 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 200 to 230 days

Map Unit Composition

Nash and similar soils: 55 percent
Ironmound and similar soils: 35 percent
Additional components: 10 percent

Major Component Description

Nash and similar soils

Geomorphic setting: Hill on upland
Position on landform: Backslope
Parent material: Sandstone
Slope range: 3 to 8 percent
Runoff: High
Depth to bedrock (paralithic): 20 to 40 inches
Slowest permeability class within a depth of 60 inches: Moderately slow
Drainage class: Well drained
Available water capacity: About 5.8 inches
Depth to water table: More than 6 feet
Flooding: None

Ironmound and similar soils

Geomorphic setting: Hill on upland

Position on landform: Backslope

Parent material: Sandstone

Slope range: 3 to 8 percent

Runoff: Very high

Depth of bedrock (paralithic): 10 to 20 inches

Slowest permeability class within a depth of 60 inches: Impermeable

Drainage class: Well drained

Available water capacity: About 1.7 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Grainola and similar soils (5 percent)
- Kingfisher and similar soils (5 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 4e

Range site number and name: Nash—080AY856OK, Reseeded Loamy Prairie;
Ironmound—080AY883OK, Reseeded Shallow Prairie

**NaD3—Nash-Ironmound complex, 3 to 8 percent slopes,
severely eroded**

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Nash and similar soils: 60 percent

Ironmound and similar soils: 30 percent

Additional components: 10 percent

Major Component Description

Nash and similar soils

Geomorphic setting: Hill on upland

Position on landform: Backslope

Parent material: Sandstone

Slope range: 3 to 8 percent

Runoff: High

Depth to bedrock (paralithic): 20 to 40 inches

Slowest permeability class within a depth of 60 inches: Moderately slow

Drainage class: Well drained

Available water capacity: About 5.8 inches

Depth to water table: More than 6 feet

Flooding: None

Ironmound and similar soils

Geomorphic setting: Hill on upland

Position on landform: Backslope

Parent material: Sandstone

Slope range: 3 to 8 percent

Runoff: Very high

Depth to bedrock (paralithic): 10 to 20 inches

Slowest permeability class within a depth of 60 inches: Impermeable

Drainage class: Well drained

Available water capacity: About 1.7 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Grainola and similar soils (5 percent)
- Kingfisher and similar soils (5 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major use of this map unit is rangeland.

Interpretive Groups

Land capability classification: Nash—6e; Ironmound—7e

Range site number and name: Nash—080AY856OK, Reseeded Loamy Prairie;
Ironmound—080AY883OK, Reseeded Shallow Prairie

NbC—Noble fine sandy loam, 3 to 5 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 800 to 1,300 feet

Mean annual precipitation: 30 to 40 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Noble and similar soils: 94 percent

Additional components: 6 percent

Major Component Description

Noble and similar soils

Geomorphic setting: Hill on upland

Position on landform: Backslope and footslope

Parent material: Coarse-loamy colluvium

Slope range: 3 to 5 percent

Runoff: Very low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderately rapid

Drainage class: Well drained

Available water capacity: About 9.2 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Darnell and similar soils (3 percent)
- Yahola and similar soils (2 percent)
- Stephenville and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 3e

Range site number and name: 084AY075OK, Sandy Savannah (west)

NrB—Norge silt loam, 1 to 3 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 900 to 1,300 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Norge and similar soils: 86 percent

Additional components: 14 percent

Major Component Description

Norge and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Tread

Parent material: Fine-silty alluvium

Slope range: 1 to 3 percent

Runoff: Very low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderately slow

Drainage class: Well drained

Available water capacity: About 11.4 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Kingfisher and similar soils (5 percent)
- Renfrow and similar soils (5 percent)
- Lovedale and similar soils (2 percent)
- Pond Creek and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 2e

Range site number and name: 080AY056OK, Loamy Prairie

NrC—Norge silt loam, 3 to 5 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 900 to 1,300 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Norge and similar soils: 100 percent

Major Component Description

Norge and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Backslope

Parent material: Fine-silty colluvium

Slope range: 3 to 5 percent

Runoff: Low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderately slow

Drainage class: Well drained

Available water capacity: About 11.4 inches

Depth to water table: More than 6 feet

Flooding: None

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 3e

Range site number and name: 080AY056OK, Loamy Prairie

NrD—Norge silt loam, 5 to 8 percent slopes

Map Unit Setting

Major land resource area: 80A
Elevation range: 900 to 1,300 feet
Mean annual precipitation: 26 to 40 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 200 to 230 days

Map Unit Composition

Norge and similar soils: 95 percent
Additional components: 5 percent

Major Component Description

Norge and similar soils

Geomorphic setting: Terrace on upland
Position on landform: Backslope
Parent material: Fine-silty colluvium
Slope range: 5 to 8 percent
Runoff: Medium
Soil depth: More than 60 inches
Slowest permeability class within a depth of 60 inches: Moderately slow
Drainage class: Well drained
Available water capacity: About 11.4 inches
Depth to water table: More than 6 feet
Flooding: None

Additional Components

- Kingfisher and similar soils (3 percent)
- Minco and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section “Soil Series and Their Morphology.” For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 4e
Range site number and name: 080AY056OK, Loamy Prairie

PIT—Pits

Map Unit Setting

Major land resource area: 80A
Elevation range: 500 to 2,200 feet
Mean annual precipitation: 22 to 48 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 190 to 240 days

Map Unit Composition

Pits: 100 percent

Major Component Description

Geomorphic setting: Borrow pit

Parent material: Mine spoil or earthy fill

Slope range: 0 to 4 percent

Runoff: High

Typical Profile

This map unit has variable material to a depth of 60 inches. The location of a representative area of this unit is about 2,500 feet south and 1,800 feet east of the northwest corner of sec. 1, T. 12 N., R. 2 W.

Interpretive Groups

Land capability classification: 8

PkA—Pond Creek silt loam, 0 to 1 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 750 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Pond Creek and similar soils: 88 percent

Additional components: 12 percent

Major Component Description

Pond Creek and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Tread

Parent material: Fine-silty alluvium

Slope range: 0 to 1 percent

Runoff: Negligible

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderately slow

Drainage class: Well drained

Available water capacity: About 11.1 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Bethany and similar soils (10 percent)
- Minco and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about

managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 1

Range site number and name: 080AY056OK, Loamy Prairie

PkB—Pond Creek silt loam, 1 to 3 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 750 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Pond Creek and similar soils: 90 percent

Additional components: 10 percent

Major Component Description

Pond Creek and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Tread

Parent material: Fine-silty alluvium

Slope range: 1 to 3 percent

Runoff: Low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderately slow

Drainage class: Well drained

Available water capacity: About 11.1 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Minco and similar soils (8 percent)
- Bethany and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section “Soil Series and Their Morphology.” For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” This major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 2e

Range site number and name: 080AY056OK, Loamy Prairie

Po—Port silt loam, 0 to 1 percent slopes, occasionally flooded

Map Unit Setting

Major land resource area: 80A
Elevation range: 700 to 1,500 feet
Mean annual precipitation: 26 to 38 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 190 to 230 days

Map Unit Composition

Port and similar soils: 97 percent
Additional components: 3 percent

Major Component Description

Port and similar soils

Geomorphic setting: Low flood plain on valley
Parent material: Fine-silty alluvium from sandstone-shale
Slope range: 0 to 1 percent
Runoff: Negligible
Soil depth: More than 60 inches
Slowest permeability class within a depth of 60 inches: Moderate
Drainage class: Well drained
Available water capacity: About 11.8 inches
Depth to water table: More than 6 feet
Flooding: Occasional

Additional Components

- Yahola and similar soils (2 percent)
- Lebron and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland (fig. 4).

Interpretive Groups

Land capability classification: 2w
Range site number and name: 080AY050OK, Loamy Bottomland

Pw—Port silty clay loam, 0 to 1 percent slopes, frequently flooded

Map Unit Setting

Major land resource area: 80A
Elevation range: 700 to 1,500 feet
Mean annual precipitation: 26 to 38 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 190 to 230 days



Figure 4.—Alfalfa hay on Port silt loam, 0 to 1 percent slopes, occasionally flooded.

Map Unit Composition

Port and similar soils: 97 percent
Additional components: 3 percent

Major Component Description

Port and similar soils

Geomorphic setting: Low flood plain on valley
Parent material: Fine-silty alluvium from sandstone-shale
Slope range: 0 to 3 percent
Runoff: Negligible
Soil depth: More than 60 inches
Slowest permeability class within a depth of 60 inches: Moderate
Drainage class: Well drained
Available water capacity: About 11.8 inches
Depth to water table: More than 6 feet
Flooding: Frequent

Additional Components

- Yahola and similar soils (2 percent)
- Lebron and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about

managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major use of this map unit is rangeland.

Interpretive Groups

Land capability classification: 5w

Range site number and name: 080AY050OK, Loamy Bottomland

QdE—Ironmound-Dill complex, 5 to 12 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 2,000 feet

Mean annual precipitation: 22 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 185 to 230 days

Map Unit Composition

Ironmound and similar soils: 66 percent

Dill and similar soils: 27 percent

Additional components: 7 percent

Major Component Description

Ironmound and similar soils

Geomorphic setting: Hill on upland

Position on landform: Backslope

Parent material: Sandstone

Slope range: 5 to 12 percent

Runoff: Very high

Depth to bedrock (paralithic): 10 to 20 inches

Slowest permeability class within a depth of 60 inches: Impermeable

Drainage class: Well drained

Available water capacity: About 2.0 inches

Depth to water table: More than 6 feet

Flooding: None

Dill and similar soils

Geomorphic setting: Hill on upland

Position on landform: Backslope

Parent material: Sandstone

Slope range: 5 to 12 percent

Runoff: Very high

Depth to bedrock (paralithic): 20 to 40 inches

Slowest permeability class within a depth of 60 inches: Moderately slow

Drainage class: Well drained

Available water capacity: About 3.9 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Wisby and similar soils (4 percent)
- Grant and similar soils (3 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major use of this map unit is rangeland.

Interpretive Groups

Land capability classification: 6e

Range site number and name: Ironmound—080AY083OK, Shallow Prairie;

Dill—080AY073OK, Sandy Prairie

QrF—Ironmound-Rock outcrop complex, 12 to 30 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 500 to 2,200 feet

Mean annual precipitation: 22 to 48 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 190 to 240 days

Map Unit Composition

Ironmound and similar soils: 69 percent

Rock outcrop: 15 percent

Additional components: 16 percent

Major Component Description

Ironmound and similar soils

Geomorphic setting: Hill on upland

Position on landform: Backslope

Parent material: Sandstone

Slope range: 12 to 30 percent

Runoff: Very high

Depth to bedrock (paralithic): 10 to 20 inches

Slowest permeability class within a depth of 60 inches: Impermeable

Drainage class: Well drained

Available water capacity: About 2.0 inches

Depth to water table: More than 6 feet

Flooding: None

Rock outcrop

Geomorphic setting: Hill on upland

Position on landform: Shoulder and backslope

Parent material: Sandstone

Slope range: 12 to 30 percent

Runoff: Very high

Depth to bedrock (paralithic): 0 to 3 inches

Slowest permeability class within a depth of 60 inches: Slow

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Dill and similar soils (7 percent)
- Wisby and similar soils (6 percent)
- Minco and similar soils (2 percent)
- Noble and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section “Soil Series and Their Morphology.” For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major use of this map unit is rangeland.

Interpretive Groups

Land capability classification: Ironmound—7e; Rock outcrop—8s

Range site number and name: Ironmound—080AY083OK, Shallow Prairie; Rock outcrop—none assigned

Ra—Reinach very fine sandy loam, 0 to 1 percent slopes, rarely flooded

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,300 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Reinach and similar soils: 95 percent

Additional components: 5 percent

Major Component Description

Reinach and similar soils

Geomorphic setting: High flood plain on valley

Parent material: Coarse-silty alluvium

Slope range: 0 to 1 percent

Runoff: Negligible

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 10.6 inches

Depth to water table: More than 6 feet

Flooding: Rare

Additional Components

- Port and similar soils (2 percent)
- Yahola and similar soils (2 percent)
- Lebron and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section

“Soil Series and Their Morphology.” For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major uses for this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 1

Range site number and name: 080AY050OK, Loamy Bottomland

RbA—Renfrow silt loam, 0 to 1 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 900 to 1,500 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Renfrow and similar soils: 92 percent

Additional components: 8 percent

Major Component Description

Renfrow and similar soils

Geomorphic setting: Hill on upland

Position on landform: Summit

Parent material: Shale

Slope range: 0 to 1 percent

Runoff: Medium

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Very slow

Drainage class: Well drained

Available water capacity: About 10.6 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Piedmont and similar soils (5 percent)
- Norge and similar soils (3 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section “Soil Series and Their Morphology.” For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 2s

Range site number and name: 080AY010OK, Claypan Prairie (north)

RbB—Renfrow silt loam, 1 to 3 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 900 to 1,500 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Renfrow and similar soils: 87 percent

Additional components: 13 percent

Major Component Description

Renfrow and similar soils

Geomorphic setting: Hill on upland

Position on landform: Summit and shoulder

Parent material: Shale

Slope range: 1 to 3 percent

Runoff: High

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Very slow

Drainage class: Well drained

Available water capacity: About 10.6 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Grainola and similar soils (5 percent)
- Kingfisher and similar soils (5 percent)
- Norge and similar soils (3 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland (fig. 5).

Interpretive Groups

Land capability classification: 2e

Range site number and name: 080AY010OK, Claypan Prairie (north)

RcC2—Renfrow clay loam, 3 to 5 percent slopes, eroded

Map Unit Setting

Major land resource area: 80A

Elevation range: 900 to 1,500 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 190 to 230 days



Figure 5.—Wheat on Renfrow silt loam, 1 to 3 percent slopes.

Map Unit Composition

Renfrow and similar soils: 78 percent

Additional components: 22 percent

Major Component Description

Renfrow and similar soils

Geomorphic setting: Hill on upland

Position on landform: Shoulder and backslope

Parent material: Shale

Slope range: 3 to 5 percent

Runoff: High

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Very slow

Drainage class: Well drained

Available water capacity: About 10.4 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Grainola and similar soils (10 percent)
- Piedmont and similar soils (10 percent)
- Kingfisher and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section “Soil Series and Their Morphology.” For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 3e

Range site number and name: 080AY810OK, Reseeded Claypan Prairie

ShB—Lovedale fine sandy loam, 1 to 3 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 1,000 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 190 to 220 days

Map Unit Composition

Lovedale and similar soils: 95 percent

Additional components: 5 percent

Major Component Description

Lovedale and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Tread

Parent material: Fine-loamy alluvium

Slope range: 1 to 3 percent

Runoff: Very low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 7.1 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Konawa and similar soils (2 percent)
- Norge and similar soils (2 percent)
- Carwile and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section “Soil Series and Their Morphology.” For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major uses for this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 2e

Range site number and name: 080AY073OK, Sandy Prairie

ShC—Lovedale fine sandy loam, 3 to 5 percent slopes

Map Unit Setting

Major land resource area: 80A
Elevation range: 1,000 to 1,500 feet
Mean annual precipitation: 26 to 38 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 190 to 220 days

Map Unit Composition

Lovedale and similar soils: 90 percent
Additional components: 10 percent

Major Component Description

Lovedale and similar soils

Geomorphic setting: Terrace on upland
Position on landform: Tread
Parent material: Fine-loamy alluvium
Slope range: 3 to 5 percent
Runoff: Low
Soil depth: More than 60 inches
Slowest permeability class within a depth of 60 inches: Moderate
Drainage class: Well drained
Available water capacity: About 7.1 inches
Depth to water table: More than 6 feet
Flooding: None

Additional Components

- Grant and similar soils (2 percent)
- Kingfisher and similar soils (2 percent)
- Konawa and similar soils (2 percent)
- Norge and similar soils (2 percent)
- Wisby and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses for this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 3e
Range site number and name: 080AY073OK, Sandy Prairie

ShD—Lovedale fine sandy loam, 5 to 8 percent slopes

Map Unit Setting

Major land resource area: 80A
Elevation range: 1,000 to 1,500 feet
Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 190 to 220 days

Map Unit Composition

Lovedale and similar soils: 92 percent

Additional components: 8 percent

Major Component Description

Lovedale and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Backslope

Parent material: Fine-loamy alluvium

Slope range: 5 to 8 percent

Runoff: Medium

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 7.1 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Konawa and similar soils (3 percent)
- Norge and similar soils (3 percent)
- Wisby and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 4e

Range site number and name: 080AY073OK, Sandy Prairie

ShD2—Lovedale fine sandy loam, 5 to 8 percent slopes, eroded

Map Unit Setting

Major land resource area: 80A

Elevation range: 1,000 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 190 to 220 days

Map Unit Composition

Lovedale and similar soils: 81 percent

Additional components: 19 percent

Major Component Description

Lovedale and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Backslope

Parent material: Fine-loamy alluvium

Slope range: 5 to 8 percent

Runoff: Medium

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 7.1 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Grant and similar soils (5 percent)
- Konawa and similar soils (5 percent)
- Wisby and similar soils (5 percent)
- Kingfisher and similar soils (2 percent)
- Norge and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 4e

Range site number and name: 080AY873OK, Reseeded Sandy Prairie

SnE—Lovedale-Wisby complex, 5 to 12 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 1,000 to 2,000 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 190 to 220 days

Map Unit Composition

Lovedale and similar soils: 60 percent

Wisby and similar soils: 30 percent

Additional components: 10 percent

Major Component Description

Lovedale and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Backslope

Parent material: Fine-loamy alluvium

Slope range: 5 to 12 percent

Runoff: Medium

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderate

Drainage class: Well drained

Available water capacity: About 7.1 inches

Depth to water table: More than 6 feet

Flooding: None

Wisby and similar soils

Geomorphic setting: Terrace on upland

Position on landform: Backslope

Parent material: Coarse-loamy alluvium

Slope range: 5 to 12 percent

Runoff: Medium

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderately rapid

Drainage class: Somewhat excessively drained

Available water capacity: About 6.2 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Dill and similar soils (5 percent)
- Ironmound and similar soils (5 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major use of this map unit is rangeland.

Interpretive Groups

Land capability classification: 6e

Range site number and name: 080AY073OK, Sandy Prairie

Tv—Goodnight fine sand, 15 to 30 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 200 to 230 days

Map Unit Composition

Goodnight and similar soils: 90 percent

Additional components: 10 percent

Major Component Description

Goodnight and similar soils

Geomorphic setting: Dune on dune field on sandhills on valley associated with high and low flood plains

Parent material: Sandy eolian deposits

Slope range: 8 to 20 percent

Runoff: Low

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Rapid

Drainage class: Excessively drained

Available water capacity: About 3.8 inches

Depth to water table: More than 6 feet

Flooding: None

Additional Components

- Gracemore and similar soils (5 percent)
- Canadian and similar soils (2 percent)
- Yahola and similar soils (2 percent)
- Ezell and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major use of this map unit is rangeland.

Interpretive Groups

Land capability classification: 6e

Range site number and name: 080AY022OK, Dune

VeC—Grainola clay loam, 3 to 5 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 800 to 1,500 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 200 to 220 days

Map Unit Composition

Grainola and similar soils: 80 percent

Additional components: 20 percent

Major Component Description

Grainola and similar soils

Geomorphic setting: Hill on upland

Position on landform: Shoulder and backslope

Parent material: Clayey shale

Slope range: 3 to 5 percent

Runoff: Very high

Depth to bedrock (paralithic): 20 to 40 inches

Slowest permeability class within a depth of 60 inches: Impermeable

Drainage class: Well drained

Available water capacity: About 4.8 inches

Depth to water table: More than 6 feet

Flooding: None



Figure 6.—Rangeland on Grainola clay loam, 3 to 5 percent slopes.

Additional Components

- Masham and similar soils (10 percent)
- Renfrow and similar soils (10 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section “Soil Series and Their Morphology.” For general and detailed information about managing this map unit, see the sections “Use and Management of the Soils” and “Soil Properties.” The major uses of this map unit are cropland and rangeland (fig. 6).

Interpretive Groups

Land capability classification: 4e

Range site number and name: 080AY010OK, Claypan Prairie (north)

VrE—Grainola-Rock outcrop complex, 5 to 15 percent slopes

Map Unit Setting

Major land resource area: 80A

Elevation range: 500 to 2,200 feet

Mean annual precipitation: 22 to 48 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 190 to 240 days

Map Unit Composition

Grainola and similar soils: 60 percent

Rock outcrop: 20 percent
Additional components: 20 percent

Major Component Description

Grainola and similar soils

Geomorphic setting: Hill on upland
Position on landform: Backslope
Parent material: Clayey shale
Slope range: 5 to 12 percent
Runoff: Very high
Depth to bedrock (paralithic): 20 to 40 inches
Slowest permeability class within a depth of 60 inches: Impermeable
Drainage class: Well drained
Available water capacity: About 4.9 inches
Depth to water table: More than 6 feet
Flooding: None

Rock outcrop

Geomorphic setting: Hill on upland
Position on landform: Backslope
Parent material: Sandstone
Slope range: 5 to 15 percent
Runoff: Very high
Depth to bedrock (paralithic): 0 to 3 inches
Slowest permeability class within a depth of 60 inches: Slow
Depth to water table: More than 6 feet
Flooding: None

Additional Components

- Ironmound and similar soils (10 percent)
- Masham and similar soils (10 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major use of this map unit is rangeland.

Interpretive Groups

Land capability classification: Grainola—6e; Rock outcrop—8s
Range site number and name: Grainola—080AY010OK, Claypan Prairie (north); Rock outcrop—none assigned

VsC2—Grainola soils, 3 to 5 percent slopes, eroded

Map Unit Setting

Major land resource area: 80A
Elevation range: 800 to 1,500 feet
Mean annual precipitation: 26 to 40 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 200 to 220 days

Map Unit Composition

Grainola and similar soils: 75 percent
Additional components: 25 percent

Major Component Description

Grainola and similar soils

Geomorphic setting: Hill on upland
Position on landform: Backslope
Parent material: Clayey shale
Slope range: 3 to 5 percent
Runoff: Very high
Depth to bedrock (paralithic): 20 to 40 inches
Slowest permeability class within a depth of 60 inches: Impermeable
Drainage class: Well drained
Available water capacity: About 4.4 inches
Depth to water table: More than 6 feet
Flooding: None

Additional Components

- Masham and similar soils (10 percent)
- Renfrow and similar soils (10 percent)
- Kingfisher and similar soils (5 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 4e
Range site number and name: 080AY810OK, Reseeded Claypan Prairie

W—Water

Map Unit Setting

Major land resource area: 80A
Elevation range: 250 to 4,000 feet
Mean annual precipitation: 22 to 48 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 190 to 240 days

Map Unit Composition

Water: 100 percent

Typical Profile and Use and Management

A typical profile is not given for this map unit. Additional information specific to this map unit is provided in the sections "Use and Management of the Soils" and "Soil Properties."

Interpretive Groups

Land capability classification: None assigned
Range site number and name: None assigned

Wa—Watonga silty clay, 0 to 1 percent slopes, rarely flooded

Map Unit Setting

Major land resource area: 80A
Elevation range: 800 to 1,300 feet
Mean annual precipitation: 26 to 40 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 200 to 220 days

Map Unit Composition

Watonga and similar soils: 85 percent
Additional components: 15 percent

Major Component Description

Watonga and similar soils

Geomorphic setting: High flood plain on valley
Parent material: Clayey alluvium
Slope range: 0 to 1 percent
Runoff: Medium
Soil depth: More than 60 inches
Slowest permeability class within a depth of 60 inches: Very slow
Drainage class: Moderately well drained
Available water capacity: About 9.5 inches
Depth to water table: More than 6 feet
Flooding: Rare

Additional Components

- Dale and similar soils (10 percent)
- Brewer and similar soils (3 percent)
- Lebron and similar soils (1 percent)
- Reinach and similar soils (1 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland (fig. 7).

Interpretive Groups

Land capability classification: 3w
Range site number and name: 080AY045OK, Heavy Bottomland

Ya—Yahola fine sandy loam, 0 to 1 percent slopes, occasionally flooded

Map Unit Setting

Major land resource area: 80A
Elevation range: 800 to 1,300 feet
Mean annual precipitation: 26 to 40 inches



Figure 7.—Wheat on Watonga silty clay, 0 to 1 percent slopes, rarely flooded.

Mean annual air temperature: 57 to 64 degrees F

Frost-free period: 190 to 230 days

Map Unit Composition

Yahola and similar soils: 78 percent

Additional components: 22 percent

Major Component Description

Yahola and similar soils

Geomorphic setting: Low flood plain on valley

Parent material: Loamy alluvium

Slope range: 0 to 1 percent

Runoff: Negligible

Soil depth: More than 60 inches

Slowest permeability class within a depth of 60 inches: Moderately rapid

Drainage class: Well drained

Available water capacity: About 9.1 inches

Depth to water table: More than 6 feet

Flooding: Occasional

Additional Components

- Canadian and similar soils (10 percent)
- Goodnight and similar soils (5 percent)
- Gracemore and similar soils (5 percent)
- Ezell and similar soils (2 percent)

Typical Profile and Use and Management

A typical profile description and range in characteristics are provided in the section "Soil Series and Their Morphology." For general and detailed information about managing this map unit, see the sections "Use and Management of the Soils" and "Soil Properties." The major uses of this map unit are cropland and rangeland.

Interpretive Groups

Land capability classification: 2w

Range site number and name: 080AY050OK, Loamy Bottomland

Soil Survey of Canadian County, Oklahoma

Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
BeA	Bethany silt loam, 0 to 1 percent slopes-----	40,787	7.1
BnC	Binger fine sandy loam, 3 to 5 percent slopes-----	3,116	0.5
Br	Brewer silty clay loam, 0 to 1 percent slopes, rarely flooded-----	4,184	0.7
Bu	Brewer-Drummond complex, 0 to 1 percent slopes, rarely flooded-----	3,417	0.6
Ca	Canadian fine sandy loam, 0 to 1 percent slopes, rarely flooded-----	16,592	2.9
Da	Dale silt loam, 0 to 1 percent slopes, rarely flooded-----	24,499	4.2
DAM	Large dam-----	69	*
DnF	Darnell-Noble complex, 15 to 30 percent slopes-----	6,437	1.1
DuD	Dill-Ironmound complex, 5 to 8 percent slopes-----	9,779	1.7
Da	Dale silt loam, 0 to 1 percent slopes, rarely flooded-----	5,267	0.9
DUM	Dumps-----	86	*
Ga	Gracemore loamy fine sand, 0 to 1 percent slopes, occasionally flooded---	12,892	2.2
Gb	Gracemore soils, 0 to 1 percent slopes, frequently flooded-----	9,624	1.7
GdB	Konawa fine sandy loam, 1 to 3 percent slopes-----	1,195	0.2
GdC	Konawa fine sandy loam, 3 to 5 percent slopes-----	3,412	0.6
GdC2	Konawa fine sandy loam, 3 to 5 percent slopes, eroded-----	1,451	0.3
GdD	Konawa fine sandy loam, 5 to 8 percent slopes-----	2,153	0.4
GdD3	Konawa fine sandy loam, 3 to 8 percent slopes, severely eroded-----	2,531	0.4
GhB	Grant-Pawhuska complex, 1 to 3 percent slopes-----	6,571	1.1
GpE	Grant-Port complex, 0 to 12 percent slopes-----	23,719	4.1
GuD	Grant-Ironmound complex, 5 to 8 percent slopes-----	6,017	1.0
GuD2	Grant-Ironmound complex, 3 to 8 percent slopes, eroded-----	2,400	0.4
KfB	Kingfisher silt loam, 1 to 3 percent slopes-----	16,171	2.8
KfC	Kingfisher silt loam, 3 to 5 percent slopes-----	20,186	3.5
KrA	Kirkland silt loam, 0 to 1 percent slopes-----	13,141	2.3
KrB	Kirkland silt loam, 1 to 3 percent slopes-----	11,538	2.0
KsB	Kirkland-Pawhuska complex, 1 to 3 percent slopes-----	3,202	0.6
KwD	Konawa loamy fine sand, 3 to 8 percent slopes-----	6,814	1.2
M-W	Miscellaneous water-----	415	*
Mc	McLain silty clay loam, 0 to 1 percent slopes, rarely flooded-----	4,827	0.8
MnD	Minco very fine sandy loam, 5 to 8 percent slopes-----	5,018	0.9
MnF	Minco very fine sandy loam, 8 to 30 percent slopes-----	4,928	0.9
MsB	Minco silt loam, 1 to 3 percent slopes-----	4,514	0.8
MsC	Minco silt loam, 3 to 5 percent slopes-----	8,573	1.5
NaD	Nash-Ironmound complex, 3 to 8 percent slopes-----	12,683	2.2
NaD2	Nash-Ironmound complex, 3 to 8 percent slopes, eroded-----	5,730	1.0
NaD3	Nash-Ironmound complex, 3 to 8 percent slopes, severely eroded-----	1,230	0.2
NbC	Noble fine sandy loam, 3 to 5 percent slopes-----	5,024	0.9
NrB	Norge silt loam, 1 to 3 percent slopes-----	48,631	8.4
NrC	Norge silt loam, 3 to 5 percent slopes-----	45,945	7.9
NrD	Norge silt loam, 5 to 8 percent slopes-----	3,655	0.6
PIT	Pits-----	157	*
PkA	Pond Creek silt loam, 0 to 1 percent slopes-----	18,865	3.3
PkB	Pond Creek silt loam, 1 to 3 percent slopes-----	8,374	1.4
Po	Port silt loam, 0 to 1 percent slopes, occasionally flooded-----	19,708	3.4
Pw	Port silty clay loam, 0 to 1 percent slopes, frequently flooded-----	6,021	1.0
QdE	Ironmound-Dill complex, 5 to 12 percent slopes-----	2,924	0.5
QrF	Ironmound-Rock outcrop complex, 12 to 30 percent slopes-----	5,040	0.9
Ra	Reinach very fine sandy loam, 0 to 1 percent slopes, rarely flooded-----	6,376	1.1
RbA	Renfrow silt loam, 0 to 1 percent slopes-----	2,359	0.4
RbB	Renfrow silt loam, 1 to 3 percent slopes-----	9,175	1.6
RcC2	Renfrow clay loam, 3 to 5 percent slopes, eroded-----	17,239	3.0
ShB	Lovedale fine sandy loam, 1 to 3 percent slopes-----	15,298	2.6
ShC	Lovedale fine sandy loam, 3 to 5 percent slopes-----	10,837	1.9
ShD	Lovedale fine sandy loam, 5 to 8 percent slopes-----	4,087	0.7
ShD2	Lovedale fine sandy loam, 5 to 8 percent slopes, eroded-----	1,292	0.2
SnE	Lovedale-Wisby complex, 5 to 12 percent slopes-----	2,367	0.4
Tv	Goodnight fine sand, 15 to 30 percent slopes-----	3,487	0.6
VeC	Grainola clay loam, 3 to 5 percent slopes-----	3,607	0.6
VrE	Grainola-Rock outcrop complex, 5 to 15 percent slopes-----	6,044	1.0

See footnote at end of table.

Soil Survey of Canadian County, Oklahoma

Acreage and Proportionate Extent of the Soils—Continued

Map symbol	Soil name	Acres	Percent
VsC2	Grainola soils, 3 to 5 percent slopes, eroded-----	1,856	0.3
W	Water -----	10,188	1.8
Wa	Watonga silty clay, 0 to 1 percent slopes, rarely flooded-----	7,486	1.3
Ya	Yahola fine sandy loam, 0 to 1 percent slopes, occasionally flooded-----	7,279	1.3
	Total-----	578,489	100.0

* Less than 1 percent.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior (fig. 8).

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Interpretive ratings help engineers, planners, and others understand how soil properties influence important nonagricultural uses, such as building site development and construction materials. The ratings indicate the most restrictive soil features affecting the suitability of the soils for these uses.

Soils are rated in their natural state. No unusual modification of the soil site or material is made other than that which is considered normal practice for the rated use. Even though soils may have limitations, it is important to remember that engineers and others can modify soil features or can design or adjust the plans for a structure to compensate for most of the limitations. Most of these practices, however, are costly. The final decision in selecting a site for a particular use generally involves weighing the costs of site preparation and maintenance.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Agronomy

General management concerns affecting the production of crops and hay and pasture plants are identified in this section. The system of land capability classification used by the Natural Resources Conservation Service is explained, the estimated yields of the main crops and hay and pasture plants are listed for each soil, and prime farmland is discussed.

Planners of management systems for individual fields or farms should consider



Figure 8.—Figure shows boundary between flood plain and upland soils. Areas of Dale silt loam, 0 to 1 percent slopes, rarely flooded, are in the foreground. Areas of Lovedale fine sandy loam are in the background.

specific information available from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, woodland, or engineering purposes.

In the capability system, soils generally are grouped at three levels: capability class, subclass, and unit (8). These levels indicate the degree and kinds of limitations affecting mechanized farming systems that produce the more commonly grown field crops, such as corn, small grain, cotton, hay, and field-grown vegetables. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Arabic numerals 1 through 8. The numerals indicate progressively greater limitations and narrower choices for practical use.

If properly managed, soils in classes 1, 2, 3, and 4 are suitable for the mechanized production of commonly grown field crops and for pasture and woodland. The degree of the soil limitations affecting the production of cultivated crops increases progressively from class 1 to class 4. The limitations can affect levels of production and the risk of permanent soil deterioration caused by erosion and other factors.

Soils in classes 5, 6, and 7 are generally not suited to the mechanized production of commonly grown field crops without special management, but they are suitable for plants that provide a permanent cover, such as grasses and trees. The severity of the soil limitations affecting crops increases progressively from class 5 to class 7. The local office of the Natural Resources Conservation Service or the Cooperative Extension Service can provide guidance on the use of these soils as cropland.

Areas in class 8 are generally not suitable for crops, pasture, rangeland, or woodland. These areas may have potential for other uses, such as recreational facilities and wildlife habitat.

Capability subclasses identify the dominant kind of limitation in the class. They are designated by adding a small letter, e, w, s, or c, to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless a close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

There are no subclasses in class 1 because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by w, s, or c because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use mainly to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the table "Land Capability and Yields per Acre of Crops and Pasture, Parts I and II" and in the section "Detailed Soil Map Units."

Estimated Yields of Crops and Pasture

The average yields per acre that can be expected of the principal crops under a high level of management are shown in the table "Land Capability and Yields per Acre of Crops and Pasture, Parts I and II." In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in the table are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small.

Under good pasture management, proper grazing is essential for the production of high-quality forage, stand survival, and erosion control. Proper grazing helps plants to maintain sufficient and generally vigorous top growth during the growing season (fig. 9). Brush control is essential in many areas, and weed control generally is needed. Rotation grazing and renovation also are important management practices.

A pasture program is needed to provide the desired amount of forage during each month of the year. A study of the growth habits of the different plants is necessary to ensure adequate forage during each month. The months that various kinds of forage



Figure 9.—Cattle in an area of wheat pasture on Renfrow clay loam, 3 to 5 percent slopes, eroded.

plants grow are indicated in figure 11, which is in the “Range” section. The percent growth that can be safely grazed each month without substantially reducing the total yield for each kind of plant is illustrated.

Yield estimates are often indicated in animal unit months (AUM), or the amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about forage yields other than those shown in the table.

Soil Survey of Canadian County, Oklahoma

Land Capability and Yields per Acre of Crops and Pasture, Part I

(Yields are those that can be expected under a high level of management. They are for nonirrigated areas. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Map symbol and soil name	Land capability	Cotton lint	Grain sorghum	Peanuts	Soybeans	Wheat
		<u>Lbs</u>	<u>Bu</u>	<u>Lbs</u>	<u>Bu</u>	<u>Bu</u>
BeA: Bethany-----	1	400.00	50.00	---	---	35.00
BnC: Binger-----	3e	300.00	35.00	1,300.00	---	20.00
Br: Brewer-----	1	500.00	55.00	---	---	35.00
Bu: Brewer-----	1	500.00	55.00	---	---	35.00
Drummond-----	6s	---	---	---	---	---
Ca: Canadian-----	1	450.00	55.00	---	---	35.00
Da: Dale-----	1	500.00	70.00	1,700.00	30.00	35.00
DAM. Large dam						
DnD: Darnell-----	6e	---	---	---	---	---
Noble-----	6e	---	---	---	---	---
DnF: Darnell-----	7e	---	---	---	---	---
Noble-----	7e	---	---	---	---	---
DuD: Dill-----	4e	---	20.00	---	---	15.00
Ironmound-----	4e	---	---	---	---	10.00
DUM. Dumps						
Ga: Gracemore-----	3w	---	35.00	---	---	20.00
Gb: Gracemore-----	5w	---	---	---	---	---
GdB: Konawa-----	2e	450.00	50.00	1,700.00	28.00	30.00
GdC: Konawa-----	3e	450.00	50.00	1,500.00	26.00	30.00
GdC2: Konawa-----	3e	300.00	35.00	1,000.00	---	20.00

Soil Survey of Canadian County, Oklahoma

Land Capability and Yields per Acre of Crops and Pasture, Part I—Continued

Map symbol and soil name	Land capability	Cotton lint	Grain sorghum	Peanuts	Soybeans	Wheat
		<u>Lbs</u>	<u>Bu</u>	<u>Lbs</u>	<u>Bu</u>	<u>Bu</u>
GdD:						
Konawa-----	4e	400.00	40.00	1,300.00	---	25.00
GdD3:						
Konawa-----	6e	---	---	---	---	---
GhB:						
Grant-----	2e	350.00	50.00	---	---	30.00
Pawhuska-----	4s	---	---	---	---	15.00
GpE:						
Grant-----	6e	---	---	---	---	---
Port-----	5w	---	---	---	---	---
GuD:						
Grant-----	4e	---	35.00	---	---	20.00
Ironmound-----	4e	---	---	---	---	10.00
GuD2:						
Grant-----	4e	---	---	---	---	15.00
Ironmound-----	4e	---	---	---	---	10.00
KfB:						
Kingfisher-----	2e	---	40.00	---	---	30.00
KfC:						
Kingfisher-----	3e	---	35.00	---	---	25.00
KrA:						
Kirkland-----	2s	300.00	40.00	---	---	30.00
KrB:						
Kirkland-----	3e	250.00	35.00	---	---	25.00
KsB:						
Kirkland-----	3e	250.00	35.00	---	---	25.00
Pawhuska-----	4s	---	---	---	---	15.00
KwD:						
Konawa-----	4e	250.00	30.00	1,100.00	---	20.00
Mc:						
McLain-----	1	500.00	55.00	---	---	35.00
MnD:						
Minco-----	4e	---	---	---	---	25.00
MnF:						
Minco-----	6e	---	---	---	---	---
MsB:						
Minco-----	2e	450.00	45.00	1,850.00	---	30.00
MsC:						
Minco-----	3e	400.00	40.00	1,700.00	---	30.00

Soil Survey of Canadian County, Oklahoma

Land Capability and Yields per Acre of Crops and Pasture, Part I—Continued

Map symbol and soil name	Land capability	Cotton lint	Grain sorghum	Peanuts	Soybeans	Wheat
		<u>Lbs</u>	<u>Bu</u>	<u>Lbs</u>	<u>Bu</u>	<u>Bu</u>
M-W. Miscellaneous water						
NaD: Nash-----	4e	---	25.00	---	---	15.00
Ironmound-----	4e	---	---	---	---	10.00
NaD2: Nash-----	4e	---	20.00	---	---	10.00
Ironmound-----	4e	---	---	---	---	10.00
NaD3: Nash-----	6e	---	---	---	---	---
Ironmound-----	7e	---	---	---	---	---
NbC: Noble-----	3e	300.00	35.00	1,000.00	---	20.00
NrB: Norge-----	2e	400.00	50.00	---	---	30.00
NrC: Norge-----	3e	350.00	40.00	---	---	25.00
NrD: Norge-----	4e	300.00	35.00	---	---	20.00
PIT. Pits						
PkA: Pond Creek-----	1	450.00	50.00	---	---	35.00
PkB: Pond Creek-----	2e	400.00	45.00	---	---	30.00
Po: Port-----	2w	500.00	50.00	---	---	35.00
Pw: Port-----	5w	---	---	---	---	---
QdE: Ironmound-----	6e	---	---	---	---	---
Dill-----	6e	---	---	---	---	---
QrF: Ironmound-----	7e	---	---	---	---	---
Rock outcrop-----	8s	---	---	---	---	---
Ra: Reinach-----	1	500.00	55.00	---	---	35.00
RbA: Renfrow-----	2s	300.00	35.00	---	---	25.00

Soil Survey of Canadian County, Oklahoma

Land Capability and Yields per Acre of Crops and Pasture, Part I—Continued

Map symbol and soil name	Land capability	Cotton lint	Grain sorghum	Peanuts	Soybeans	Wheat
		<u>Lbs</u>	<u>Bu</u>	<u>Lbs</u>	<u>Bu</u>	<u>Bu</u>
RbB: Renfrow-----	2e	250.00	30.00	---	---	20.00
RcC2: Renfrow-----	3e	---	---	---	---	15.00
ShB: Lovedale-----	2e	---	45.00	---	---	30.00
ShC: Lovedale-----	3e	---	35.00	---	---	25.00
ShD: Lovedale-----	4e	---	34.00	---	---	20.00
ShD2: Lovedale-----	4e	---	30.00	---	---	18.00
SnE: Lovedale-----	6e	---	---	---	---	---
Wisby-----	6e	---	---	---	---	---
Tv: Goodnight-----	6e	---	---	---	---	---
VeC: Grainola-----	4e	---	30.00	---	---	15.00
VrE: Grainola-----	6e	---	---	---	---	---
Rock outcrop-----	8s	---	---	---	---	---
VsC2: Grainola-----	4e	---	---	---	---	10.00
W. Water						
Wa: Watonga-----	3w	400.00	50.00	---	---	30.00
Ya: Yahola-----	2w	425.00	50.00	1,600.00	---	35.00

Soil Survey of Canadian County, Oklahoma

Land Capability and Yields per Acre of Crops and Pasture, Part II

(Yields are those that can be expected under a high level of management. They are for nonirrigated areas. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Map symbol and soil name	Land capability	Alfalfa hay	Improved bermudagrass	Introduced bluestem	Tall fescue	Weeping lovegrass
		<u>Tons</u>	<u>AUM</u>	<u>AUM</u>	<u>AUM</u>	<u>AUM</u>
BeA: Bethany-----	1	3.50	5.00	5.50	---	---
BnC: Binger-----	3e	---	5.50	---	---	5.00
Br: Brewer-----	1	4.30	7.00	---	---	---
Bu: Brewer-----	1	4.30	7.00	---	---	---
Drummond-----	6s	---	6.00	---	6.00	---
Ca: Canadian-----	1	4.00	8.50	---	---	---
Da: Dale-----	1	5.50	8.50	---	---	---
DAM. Large dam						
DnD: Darnell-----	6e	---	3.00	---	---	3.50
Noble-----	6e	---	4.50	---	---	4.50
DnF: Darnell-----	7e	---	---	---	---	---
Noble-----	7e	---	---	---	---	---
DuD: Dill-----	4e	---	4.50	4.50	---	4.50
Ironmound-----	4e	---	2.00	---	---	---
DUM. Dumps						
Ga: Gracemore-----	3w	3.00	7.00	---	6.00	---
Gb: Gracemore-----	5w	---	7.00	---	6.00	---
GdB: Konawa-----	2e	---	4.50	---	---	5.00
GdC: Konawa-----	3e	---	4.50	---	---	5.00
GdC2: Konawa-----	3e	---	3.50	---	---	4.00

Soil Survey of Canadian County, Oklahoma

Land Capability and Yields per Acre of Crops and Pasture, Part II—Continued

Map symbol and soil name	Land capability	Alfalfa hay	Improved bermudagrass	Introduced bluestem	Tall fescue	Weeping lovegrass
		<u>Tons</u>	<u>AUM</u>	<u>AUM</u>	<u>AUM</u>	<u>AUM</u>
GdD:						
Konawa-----	4e	---	4.00	---	---	4.50
GdD3:						
Konawa-----	6e	---	3.00	---	---	3.50
GhB:						
Grant-----	2e	2.30	5.50	5.00	---	5.50
Pawhuska-----	4s	---	3.50	---	---	---
GpE:						
Grant-----	6e	---	4.50	4.00	---	4.50
Port-----	5w	---	8.50	---	---	---
GuD:						
Grant-----	4e	---	4.50	4.00	---	4.50
Ironmound-----	4e	---	2.00	---	---	---
GuD2:						
Grant-----	4e	---	4.00	3.50	---	4.00
Ironmound-----	4e	---	2.00	---	---	---
KfB:						
Kingfisher-----	2e	---	5.00	4.50	---	---
KfC:						
Kingfisher-----	3e	---	4.50	4.00	---	---
KrA:						
Kirkland-----	2s	---	4.00	---	---	4.00
KrB:						
Kirkland-----	3e	---	4.00	---	---	4.00
KsB:						
Kirkland-----	3e	---	4.00	---	---	4.00
Pawhuska-----	4s	---	3.50	---	---	---
KwD:						
Konawa-----	4e	---	3.50	---	---	4.00
Mc:						
McLain-----	1	4.50	8.50	6.50	---	---
MnD:						
Minco-----	4e	---	4.50	---	---	4.50
MnF:						
Minco-----	6e	---	4.00	---	---	4.00
MsB:						
Minco-----	2e	3.00	5.50	---	---	5.50
MsC:						
Minco-----	3e	2.50	5.00	---	---	5.00

Soil Survey of Canadian County, Oklahoma

Land Capability and Yields per Acre of Crops and Pasture, Part II—Continued

Map symbol and soil name	Land capability	Alfalfa hay	Improved bermudagrass	Introduced bluestem	Tall fescue	Weeping lovegrass
		<u>Tons</u>	<u>AUM</u>	<u>AUM</u>	<u>AUM</u>	<u>AUM</u>
M-W. Miscellaneous water						
NaD: Nash-----	4e	---	4.50	---	---	5.50
Ironmound-----	4e	---	2.00	---	---	---
NaD2: Nash-----	4e	---	4.00	---	---	4.00
Ironmound-----	4e	---	2.00	---	---	---
NaD3: Nash-----	6e	---	3.50	---	---	---
Ironmound-----	7e	---	---	---	---	---
NbC: Noble-----	3e	---	5.50	---	---	5.50
NrB: Norge-----	2e	3.00	5.50	5.00	---	5.50
NrC: Norge-----	3e	2.00	5.00	4.50	---	5.00
NrD: Norge-----	4e	1.50	4.50	4.00	---	4.50
PIT. Pits						
PkA: Pond Creek-----	1	3.50	5.50	5.50	---	---
PkB: Pond Creek-----	2e	3.00	5.50	5.50	---	---
Po: Port-----	2w	5.00	8.50	---	---	---
Pw: Port-----	5w	---	8.50	---	---	---
QdE: Ironmound-----	6e	---	2.00	---	---	---
Dill-----	6e	---	4.00	4.00	---	4.00
QrF: Ironmound-----	7e	---	---	---	---	---
Rock outcrop-----	8s	---	---	---	---	---
Ra: Reinach-----	1	5.00	8.50	---	---	7.50
RbA: Renfrow-----	2s	---	3.50	---	---	---

Soil Survey of Canadian County, Oklahoma

Land Capability and Yields per Acre of Crops and Pasture, Part II—Continued

Map symbol and soil name	Land capability	Alfalfa hay	Improved bermudagrass	Introduced bluestem	Tall fescue	Weeping lovegrass
		<u>Tons</u>	<u>AUM</u>	<u>AUM</u>	<u>AUM</u>	<u>AUM</u>
RbB: Renfrow-----	2e	---	3.00	---	---	---
RcC2: Renfrow-----	3e	---	2.50	---	---	---
ShB: Lovedale-----	2e	2.50	5.50	---	---	6.00
ShC: Lovedale-----	3e	2.00	5.00	---	---	6.00
ShD: Lovedale-----	4e	1.50	4.00	---	---	5.00
ShD2: Lovedale-----	4e	1.00	3.00	---	---	3.50
SnE: Lovedale-----	6e	---	3.00	---	---	3.50
Wisby-----	6e	---	2.50	---	---	3.00
Tv: Goodnight-----	6e	---	2.50	---	---	3.50
VeC: Grainola-----	4e	---	3.50	---	---	---
VrE: Grainola-----	6e	---	2.50	---	---	---
Rock outcrop-----	8s	---	---	---	---	---
VsC2: Grainola-----	4e	---	3.00	---	---	---
W. Water						
Wa: Watonga-----	3w	3.50	6.50	---	---	5.50
Ya: Yahola-----	2w	5.00	7.00	---	---	---

Cropland Limitations and Hazards

The management concerns affecting the use of the detailed map units in the survey area for crops are shown in the table "Cropland Limitations and Hazards." The main concerns in managing nonirrigated cropland are conserving moisture, controlling soil blowing and water erosion, and maintaining soil fertility and tilth.

Conserving moisture primarily involves reducing the evaporation and runoff rates and increasing the rate of water infiltration. Applying conservation tillage and conservation cropping systems, farming on the contour, stripcropping, establishing field windbreaks, and leaving crop residue on the surface conserve moisture.

Generally, a combination of several practices is needed to control soil blowing and water erosion. Conservation tillage, stripcropping, field windbreaks, tall grass barriers, contour farming, conservation cropping systems, crop residue management, diversions, and grassed waterways help to prevent excessive soil loss.

Measures that are effective in maintaining *soil fertility* include applying fertilizer, both organic and inorganic, including manure; incorporating crop residue or green manure crops into the soil; and using proper crop rotations. Controlling erosion helps to prevent the loss of organic matter and plant nutrients and thus helps to maintain productivity, although the level of fertility can be reduced even in areas where erosion is controlled. All soils used for nonirrigated crops respond well to applications of fertilizer.

On irrigated soils the main management concerns are *efficient water use, nutrient management, control of erosion, soil tilth, pest and weed control, and timely planting and harvesting* for a successful crop. An irrigation system that provides optimum control and distribution of water at minimum cost is needed. Overirrigation wastes water, leaches plant nutrients, and causes erosion. Also, it can create drainage problems, raise the water table, and increase soil salinity.

Some of the limitations and hazards shown in the table cannot be easily overcome. These are *channels, flooding, depth to bedrock, ponding, gullies, and lack of timely precipitation*.

Additional limitations and hazards are as follows:

Areas of rock outcrop and oil waste land.—Farming around these areas may be feasible. Subsoiling or deep ripping soft sedimentary beds increases the effective rooting depth and the rate of water infiltration.

Excessive permeability.—This limitation causes deep leaching of nutrients and pesticides. The capacity of the soil to retain moisture for plant use is poor.

Potential for ground-water pollution.—This is a hazard in soils with excessive permeability, hard bedrock, or a water table within the profile.

Lime content, limited available water capacity, poor tilth, restricted permeability, and surface crusting.—The adverse effects of these limitations can be reduced by incorporating green manure crops, manure, or crop residue into the soil; applying a system of conservation tillage; and using conservation cropping systems. Also, crops may respond well to additions of phosphate fertilizer on soils that have a high content of lime.

Surface rock fragments.—This limitation causes the rapid wear of tillage equipment. It cannot be easily overcome.

Slope.—Where the slope is more than 8 percent, water erosion and soil blowing may be accelerated unless conservation farming practices are applied.

Surface stones.—Stones or boulders on the surface can hinder normal tillage unless they are removed.

Salt and sodium content.—In areas where this is a limitation, only salt- and sodium-tolerant crops should be grown.

Criteria for Limitations and Hazards

Following are explanations of the criteria used to determine the limitations or hazards.

Areas of rock outcrop.—Rock outcrop is a named component of the map unit.

Areas of rubble land.—Rubble land is a named component of the map unit.

Areas of oil waste land.—Oil waste land is a named component of the map unit.

Channeled.—The word “channeled” is included in the name of the map unit.

Depth to bedrock.—Bedrock is within a depth of 40 inches.

Water erosion.—The surface K factor multiplied by the upper slope limit is more than 2 (same as prime farmland criteria).

Excessive permeability.—The upper limit of the permeability range is 6 inches or more within the soil profile.

Flooding.—The component of the map unit is occasionally flooded or frequently flooded.

Gullied.—The word “gullied” is included in the name of the map unit.

Lime content.—The upper 10 inches has more than 15 percent calcium carbonate equivalent.

Limited available water capacity.—The available water capacity calculated to a depth of 60 inches or to a root-limiting layer is 6 inches or less.

Ponding.—A ponding duration is assigned to the component of the map unit.

Potential for ground-water pollution.—The soil has a water table within a depth of 4 feet or bedrock within a depth of 40 inches, or permeability is more than 2 inches per hour within the soil profile.

Poor tilth.—The component of the map unit has more than 35 percent clay in the surface layer.

Restricted permeability.—Permeability is 0.06 inch per hour or less within the soil profile.

Salt content.—The component of the map unit has an electrical conductivity of more than 4 in the surface layer or more than 8 within a depth of 30 inches.

Slope.—The upper slope limit of the component of the map unit is more than 8 percent.

Sodium content.—The sodium adsorption ratio of the component of the map unit is more than 13 within a depth of 30 inches.

Soil blowing.—The wind erodibility group is WEG 1, WEG 2, or WEG 3.

Surface rock fragments.—The terms describing the texture of the surface layer include any rock fragment modifier except for gravelly or channery.

Surface crusting.—The organic matter content is less than 2 percent in the surface layer.

Surface stones.—The terms describing the texture of the surface layer include any stony or bouldery modifier, or the map unit is a stony or bouldery phase.

Water table.—The component of the map unit has a water table within a depth of 3 feet.

Soil Survey of Canadian County, Oklahoma

Cropland Limitations and Hazards

(See text for a description and criteria of the limitations and hazards listed in this table)

Map symbol and component name	Cropland limitations and hazards
BeA: Bethany-----	None
BnC: Binger-----	Depth to bedrock Potential for ground-water pollution Limited available water capacity
Br: Brewer-----	Water table
Bu: Brewer-----	Water table
Drummond-----	Restricted permeability Sodium content Salt content Potential for ground-water pollution Water table Surface crusting
Ca: Canadian-----	Excessive permeability Potential for ground-water pollution
Da: Dale-----	None
DAM. Large dam	
DnD, DnF: Darnell-----	Soil blowing Water erosion Depth to bedrock Restricted permeability Potential for ground-water pollution Limited available water capacity Slope
Noble-----	Water erosion Potential for ground-water pollution Slope
DuD: Dill-----	Depth to bedrock Potential for ground-water pollution Limited available water capacity
Ironmound-----	Soil blowing Depth to bedrock Restricted permeability Potential for ground-water pollution Limited available water capacity
DUM. Dumps	

Soil Survey of Canadian County, Oklahoma

Cropland Limitations and Hazards—Continued

Map symbol and component name	Cropland limitations and hazards
Ga, Gb: Gracemore-----	Flooding Excessive permeability Potential for ground-water pollution Water table
GdB, GdC, GdC2, GdD, GdD3: Konawa-----	Potential for ground-water pollution
GhB: Grant-----	None
Pawhuska-----	Restricted permeability Sodium content Salt content Water table Surface crusting
GpE: Grant-----	Water erosion Slope
Port-----	Flooding
GuD: Grant-----	Water erosion
Ironmound-----	Water erosion Depth to bedrock Restricted permeability Limited available water capacity
GuD2: Grant-----	Water erosion Restricted permeability
Ironmound-----	Water erosion Depth to bedrock Restricted permeability Limited available water capacity
KfB, KfC: Kingfisher-----	Depth to bedrock Restricted permeability
KrA, KrB: Kirkland-----	Restricted permeability
KsB: Kirkland-----	Restricted permeability
Pawhuska-----	Restricted permeability Sodium content Salt content Water table Surface crusting
KwD: Konawa-----	Potential for ground-water pollution
Mc: McLain-----	Water table

Soil Survey of Canadian County, Oklahoma

Cropland Limitations and Hazards—Continued

Map symbol and component name	Cropland limitations and hazards
MnD: Minco-----	Water erosion
MnF: Minco-----	Water erosion Slope
MsB, MsC: Minco-----	None
M-W. Miscellaneous water	
NaD, NaD2, NaD3: Nash-----	Water erosion Depth to bedrock
Ironmound-----	Soil blowing Depth to bedrock Restricted permeability Potential for ground-water pollution Limited available water capacity
NbC: Noble-----	Potential for ground-water pollution
NrB, NrC: Norge-----	None
NrD: Norge-----	Water erosion
PIT. Pits	
PkA, PkB: Pond Creek-----	None
Po, Pw: Port-----	Flooding
QdE: Ironmound-----	Water erosion Depth to bedrock Restricted permeability Limited available water capacity Slope
Dill-----	Water erosion Depth to bedrock Potential for ground-water pollution Limited available water capacity Slope
QrF: Ironmound-----	Water erosion Depth to bedrock Restricted permeability Limited available water capacity Slope Areas of rock outcrop

Soil Survey of Canadian County, Oklahoma

Cropland Limitations and Hazards—Continued

Map symbol and component name	Cropland limitations and hazards
QrF: Rock outcrop-----	Depth to bedrock Slope Areas of rock outcrop
Ra: Reinach-----	None
RbA, RbB: Renfrow-----	Restricted permeability
RcC2: Renfrow-----	Water erosion Restricted permeability
ShB, ShC, ShD, ShD2: Lovedale-----	Excessive permeability Potential for ground-water pollution
SnE: Lovedale-----	Water erosion Excessive permeability Potential for ground-water pollution Slope
Wisby-----	Excessive permeability Potential for ground-water pollution Slope
Tv: Goodnight-----	Soil blowing Water erosion Excessive permeability Potential for ground-water pollution Limited available water capacity Slope
VeC: Grainola-----	Depth to bedrock Restricted permeability Limited available water capacity Poor tilth
VrE: Grainola-----	Water erosion Depth to bedrock Restricted permeability Limited available water capacity Slope Areas of rock outcrop Poor tilth
Rock outcrop-----	Depth to bedrock Slope Areas of rock outcrop
VsC2: Grainola-----	Depth to bedrock Restricted permeability Limited available water capacity Poor tilth

Soil Survey of Canadian County, Oklahoma

Cropland Limitations and Hazards—Continued

Map symbol and component name	Cropland limitations and hazards
W: Water-----	Non-soil material
Wa: Watonga-----	Restricted permeability Water table Poor tilth
Ya: Yahola-----	Flooding Potential for ground-water pollution



Figure 10.—Wheat on Norge silt loam, 1 to 3 percent slopes. Urbanization is in the background.

Prime Farmland

Prime farmland is of major importance in meeting the Nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, State, and Federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, feed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops. The soils need only to be treated and managed by acceptable farming methods. An adequate moisture supply and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources, and farming these soils results in the least damage to the environment (5).

Prime farmland soils may presently be used as cropland, pasture, rangeland, or woodland or for other purposes. They either are used for food and fiber or are available for these uses. Urban or built-up land, public land, and water areas are not considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites or sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water-control structures. Public land is land not available for farming in National forests, National parks, military reservations, and State parks.

Prime farmland soils commonly receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable, and the level of acidity or alkalinity and the content of salts and sodium are acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods, and they are not frequently flooded during the growing season or are protected from flooding. Slopes range from 0 to 8 percent.

Soils that have a high water table, are subject to flooding, or are droughty may

qualify as prime farmland where these limitations are overcome by drainage measures, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information about the criteria for prime farmland can be obtained at the local office of the Natural Resources Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses (fig. 10). The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 285,000 acres, or about 49 percent of the survey area, meets the requirements for prime farmland. The map units in the survey area that meet the requirements for prime farmland are listed in the table "Prime Farmland." On some soils included in the table, measures that overcome limitations are needed. The location of each map unit is shown on the detailed soil maps. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Soil Survey of Canadian County, Oklahoma

Prime Farmland

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland)

Map symbol	Soil name
BeA	Bethany silt loam, 0 to 1 percent slopes
BnC	Binger fine sandy loam, 3 to 5 percent slopes
Br	Brewer silty clay loam, 0 to 1 percent slopes, rarely flooded
Ca	Canadian fine sandy loam, 0 to 1 percent slopes, rarely flooded
Da	Dale silt loam, 0 to 1 percent slopes, rarely flooded
GdB	Konawa fine sandy loam, 1 to 3 percent slopes
GdC	Konawa fine sandy loam, 3 to 5 percent slopes
KfB	Kingfisher silt loam, 1 to 3 percent slopes
KfC	Kingfisher silt loam, 3 to 5 percent slopes
KrA	Kirkland silt loam, 0 to 1 percent slopes
KrB	Kirkland silt loam, 1 to 3 percent slopes
Mc	McLain silty clay loam, 0 to 1 percent slopes, rarely flooded
MsB	Minco silt loam, 1 to 3 percent slopes
MsC	Minco silt loam, 3 to 5 percent slopes
NbC	Noble fine sandy loam, 3 to 5 percent slopes
NrB	Norge silt loam, 1 to 3 percent slopes
NrC	Norge silt loam, 3 to 5 percent slopes
PkA	Pond Creek silt loam, 0 to 1 percent slopes
PkB	Pond Creek silt loam, 1 to 3 percent slopes
Po	Port silt loam, 0 to 1 percent slopes, occasionally flooded
Ra	Reinach very fine sandy loam, 0 to 1 percent slopes, rarely flooded
RbA	Renfrow silt loam, 0 to 1 percent slopes
RbB	Renfrow silt loam, 1 to 3 percent slopes
ShB	Lovedale fine sandy loam, 1 to 3 percent slopes
ShC	Lovedale fine sandy loam, 3 to 5 percent slopes
Wa	Watonga silty clay, 0 to 1 percent slopes, rarely flooded
Ya	Yahola fine sandy loam, 0 to 1 percent slopes, occasionally flooded

Range

Mark Moseley, Range Conservationist, Natural Resources Conservation Service, helped prepare this section.

Range, grazed forestland, and native pasture provide forage for livestock in the survey area.

Range is land on which the native vegetation (the climax, or natural potential, plant community) is predominantly grasses, grass-like plants, forbs, and shrubs suitable for grazing and browsing. Range includes natural grasslands, savannahs, many wetlands, some deserts, tundra, and certain shrub and forb communities. Range receives no regular or frequent cultural treatment. The composition and production of the plant community are determined by soil, climate, topography, overstory canopy, and grazing management.

Grazed forestland is land on which the understory includes, as an integral part of the forest plant community, plants that can be grazed without significant impairment of other forest values.

Native pasture is land on which the potential (climax) vegetation is forest but which is used and managed primarily for the production of native forage plants. Native pasture includes cutover forestland and forestland that has been cleared and is managed for native or naturalized forage plants.

The table "Rangeland Productivity and Characteristic Plant Communities" shows, for each soil, the ecological site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species.

Range makes up about 35 percent of the land in Canadian County. It is mainly located in the southwestern and northwestern parts of the county. Rangeland is used primarily for grazing by domestic cattle; however, its use as wildlife habitat is becoming increasingly important as more landowners choose to lease the hunting rights on their range and develop recreational activities for an additional source of income.

The range in the county originally produced a wide variety of tall and mid grasses interspersed with an abundance of forbs. It evolved under the collective influence of ungulate grazing, fire, variable climatic events, insects, and rodents and other wildlife. Effective range management practices that mimic the historical management can help to maintain or re-establish the high-quality plants.

Approximately 75 percent of the annual production of forage occurs in April through July, responding to spring and early summer rains. A second shorter growth period may occur in the fall if sufficient moisture is available.

An *ecological site* is a distinctive kind of land with specific physical characteristics that make it different from other sites in its ability to produce a distinctive kind and amount of vegetation.

Many different ecological sites are in the survey area. Over time, a combination of plants best suited to a particular soil and climate becomes dominant. If the soil is not excessively disturbed, this group of plants is the natural plant community for the site. Natural plant communities are not static but vary slightly from year to year and place to place.

The relationship between soils and vegetation was ascertained during this survey; thus, ecological sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important. The "Field Office Technical Guide," which is available at the local office of the Natural Resources Conservation Service, can provide specific information about ecological sites.

Total dry-weight production is the amount of vegetation that can be expected to grow annually on well managed rangeland. It includes all vegetation, whether or not it

Soil Survey of Canadian County, Oklahoma

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
IMPROVED BERMUDAGRASS				5	25	35	20	10	5			
WEeping LOVEGRASS			3	20	25	20	15	6	11			
INTRODUCED BLUESTEM				3	15	26	22	18	10	1		
SMALL GRAIN GRAZEOUT	3	9	29	27	18				1	4	6	3
FORAGE SORGHUM						14	33	33	20			
NATIVE GRASS	1	1	2	10	20	27	16	8	5	2	2	1

Figure 11.—Typical growth curves for various kinds of forage in Canadian County. The growth curve for each kind of forage indicates the percentage of the total annual growth that occurs each month.

is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruit of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are near the historical monthly average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture. Figure 11 shows a typical growth curve for native vegetation and other forage that represents the percentage of total growth that occurs each month.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as stage of maturity, exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic vegetation consists of the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil. The plants are listed by common name. In the composition column, the anticipated percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Rangeland Productivity and Characteristic Plant Communities

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		Pct
BeA: Bethany-----	Loamy Prairie 080AY0560K	5,500	3,850	2,750	little bluestem----- big bluestem----- switchgrass----- yellow indiagrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5
BnC: Binger-----	Sandy Prairie 080AY0730K	4,500	3,200	2,000	little bluestem----- big bluestem----- switchgrass----- yellow indiagrass----- blue grama----- sand sagebrush----- sideoats grama----- sand lovegrass----- skunkbush sumac-----	30 25 10 10 5 5 5 3 2
Br: Brewer-----	Heavy Bottomland 080AY0450K	5,500	3,700	2,500	switchgrass----- blue grama----- meadow dropseed----- miscellaneous perennial grasses sideoats grama----- western wheatgrass----- Canada wildrye----- alkali sacaton----- buffalograss----- fourwing saltbush----- miscellaneous perennial forbs-- prairie cordgrass----- vine mesquite-----	15 10 10 10 10 10 5 5 5 5 5 5
Bu: Brewer-----	Loamy Bottomland 080AY0500K	8,500	6,100	4,500	big bluestem----- miscellaneous perennial grasses switchgrass----- yellow indiagrass----- little bluestem----- miscellaneous perennial forbs-- eastern gramagrass----- miscellaneous trees-----	25 15 15 15 10 10 5 5

Rangeland Productivity and Characteristic Plant Communities—Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		Pct
Bu: Drummond-----	Subirrigated (saline) 080AY0970K	7,000	5,800	5,000	switchgrass-----	25
					yellow indiagrass-----	15
					alkali sacaton-----	10
					miscellaneous perennial forbs--	10
					alkali muhly-----	5
					eastern baccharis-----	5
					inland saltgrass-----	5
					miscellaneous perennial grasses	5
					prairie cordgrass-----	5
					sedge-----	5
Ca: Canadian-----	Loamy Bottomland 080AY0500K	8,500	6,100	4,500	sunflower-----	5
					western wheatgrass-----	5
					big bluestem-----	25
					miscellaneous perennial grasses	15
					switchgrass-----	15
					yellow indiagrass-----	15
					little bluestem-----	10
					miscellaneous perennial forbs--	10
					eastern gramagrass-----	5
					miscellaneous trees-----	5
Da: Dale-----	Loamy Bottomland 080AY0500K	8,500	6,100	4,500	big bluestem-----	25
					miscellaneous perennial grasses	15
					switchgrass-----	15
					yellow indiagrass-----	15
					little bluestem-----	10
					miscellaneous perennial forbs--	10
					eastern gramagrass-----	5
					miscellaneous trees-----	5
DAM. Large dam						

Rangeland Productivity and Characteristic Plant Communities—Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		Pct
DnD, DnF: Darnell-----	Shallow Savannah 084AY088OK	3,200	2,100	1,400	little bluestem-----	30
					big bluestem-----	20
					blackjack oak-----	10
					Scribner panicum-----	5
					miscellaneous perennial forbs--	5
					miscellaneous shrubs-----	5
					post oak-----	5
					purpletop tridens-----	5
					sideoats grama-----	5
					tall dropseed-----	5
					yellow indiagrass-----	5
					little bluestem-----	25
					big bluestem-----	20
Noble-----	Sandy Savannah (west) 084AY075OK	4,500	3,300	2,500	miscellaneous perennial grasses	10
					miscellaneous trees-----	10
					Scribner panicum-----	5
					miscellaneous perennial forbs--	5
					purpletop tridens-----	5
					sand lovegrass-----	5
					sideoats grama-----	5
					switchgrass-----	5
					yellow indiagrass-----	5
					sand bluestem-----	30
					little bluestem-----	25
					switchgrass-----	10
					yellow indiagrass-----	10
DuD: Dill-----	Sandy Prairie 078CY073OK	3,200	2,600	1,800	sand lovegrass-----	5
					little bluestem-----	30
					sideoats grama-----	15
					big bluestem-----	10
					blue grama-----	10
					miscellaneous perennial forbs--	10
					miscellaneous perennial grasses	10
					buffalograss-----	5
					sand dropseed-----	5
					threeawn-----	5
Ironmound-----	Shallow Prairie 080AY083OK	3,000	2,100	1,500	little bluestem-----	30
					sideoats grama-----	15
					big bluestem-----	10
					blue grama-----	10
					miscellaneous perennial forbs--	10
					miscellaneous perennial grasses	10
					buffalograss-----	5
					sand dropseed-----	5
					threeawn-----	5
DUM. Dumps						

Rangeland Productivity and Characteristic Plant Communities—Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		
Ga, Gb: Gracemore-----	Subirrigated 080AY095OK	9,000	8,000	7,000	yellow indiangrass-----	Pct
					miscellaneous perennial grasses	30
					eastern gramagrass-----	15
					sand bluestem-----	10
					sedge-----	10
GdB, GdC: Konawa-----	Sandy Savannah (central) 084AY076OK	5,000	3,500	2,500	miscellaneous shrubs-----	5
					switchgrass-----	5
					little bluestem-----	25
					big bluestem-----	20
					blackjack oak-----	10
GdC2: Konawa-----	Reseeded Sandy Savannah 084AY876OK	2,700	1,900	1,300	post oak-----	10
					Scribner panicum-----	5
					miscellaneous perennial forbs--	5
					miscellaneous trees-----	5
					purple lovegrass-----	5
GdD: Konawa-----	Sandy Savannah (central) 084AY076OK	5,000	3,500	2,500	purpletop tridens-----	5
					sand lovegrass-----	5
					switchgrass-----	5
					little bluestem-----	25
					big bluestem-----	20
GdD3: Konawa-----	Reseeded Sandy Savannah 084AY876OK	2,700	1,900	1,300	blackjack oak-----	10
					post oak-----	10
					Scribner panicum-----	5
					miscellaneous perennial forbs--	5
					miscellaneous trees-----	5
					purple lovegrass-----	5
					purpletop tridens-----	5
					sand lovegrass-----	5
					switchgrass-----	5

Rangeland Productivity and Characteristic Plant Communities—Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		Pct
GhB: Grant-----	Loamy Prairie 080AY056OK	5,500	3,850	2,750	little bluestem-----	25
					big bluestem-----	20
					switchgrass-----	10
					yellow indiagrass-----	10
					blue grama-----	5
					miscellaneous perennial forbs--	5
					sideoats grama-----	5
					tall dropseed-----	5
					alkali sacaton-----	15
					miscellaneous perennial grasses	15
Pawhuska-----	Slickspot 080AY091OK	2,000	1,400	1,000	switchgrass-----	15
					blue grama-----	10
					sideoats grama-----	10
					tall dropseed-----	10
					Scribner panicum-----	5
					dotted gayfeather-----	5
					miscellaneous perennial forbs--	5
					silver bluestem-----	5
					whorled dropseed-----	5
					little bluestem-----	25
GpE: Grant-----	Loamy Prairie 080AY056OK	5,500	3,850	2,750	big bluestem-----	20
					switchgrass-----	10
					yellow indiagrass-----	10
					blue grama-----	5
					miscellaneous perennial forbs--	5
					sideoats grama-----	5
					tall dropseed-----	5
					big bluestem-----	25
					miscellaneous perennial grasses	15
					switchgrass-----	15
Port-----	Loamy Bottomland 080AY050OK	8,500	6,100	4,500	yellow indiagrass-----	15
					little bluestem-----	10
					miscellaneous perennial forbs--	10
					eastern gramagrass-----	5
					miscellaneous trees-----	5

Rangeland Productivity and Characteristic Plant Communities—Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		
GuD: Grant-----	Loamy Prairie 080AY056OK	5,500	3,850	2,750	little bluestem-----	25
					big bluestem-----	20
					switchgrass-----	10
					yellow indiagrass-----	10
					blue grama-----	5
					miscellaneous perennial forbs--	5
					sideoats grama-----	5
					tall dropseed-----	5
Ironmound-----	Shallow Prairie 080AY083OK	3,000	2,100	1,500	little bluestem-----	30
					sideoats grama-----	15
					big bluestem-----	10
					blue grama-----	10
					miscellaneous perennial forbs--	10
					miscellaneous perennial grasses	10
					buffalograss-----	5
					sand dropseed-----	5
					threeawn-----	5
GuD2: Grant-----	Reseeded Loamy Prairie 080AY856OK	3,300	2,300	1,650	---	---
Ironmound-----	Reseeded Shallow Prairie 080AY883OK	2,000	1,400	1,000	---	---
KfB, KfC: Kingfisher-----	Loamy Prairie 080AY056OK	5,500	3,850	2,750	little bluestem-----	25
					big bluestem-----	20
					switchgrass-----	10
					yellow indiagrass-----	10
					blue grama-----	5
					miscellaneous perennial forbs--	5
					sideoats grama-----	5
					tall dropseed-----	5
KrA, KrB: Kirkland-----	Claypan Prairie (north) 080AY0100K	4,000	2,800	2,000	little bluestem-----	25
					big bluestem-----	20
					switchgrass-----	15
					yellow indiagrass-----	10
					blue grama-----	5
					buffalograss-----	5
					sideoats grama-----	5

Soil Survey of Canadian County, Oklahoma

Rangeland Productivity and Characteristic Plant Communities—Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		Pct
KSB: Kirkland-----	Claypan Prairie (north) 080AY0100K	4,000	2,800	2,000	little bluestem-----	25
					big bluestem-----	20
					switchgrass-----	15
					yellow indiagrass-----	10
					blue grama-----	5
					buffalograss-----	5
					sideoats grama-----	5
Pawhuska-----	Slickspot 080AY0910K	2,000	1,400	1,000	alkali sacaton-----	15
					miscellaneous perennial grasses	15
					switchgrass-----	15
					blue grama-----	10
					sideoats grama-----	10
					tall dropseed-----	10
					Scribner panicum-----	5
					dotted gayfeather-----	5
					miscellaneous perennial forbs--	5
					silver bluestem-----	5
					whorled dropseed-----	5
KwD: Konawa-----	Deep Sand Savannah 084AY0180K	4,000	2,800	2,000	little bluestem-----	25
					big bluestem-----	20
					blackjack oak-----	10
					miscellaneous perennial grasses	10
					post oak-----	10
					Scribner panicum-----	5
					miscellaneous perennial forbs--	5
					miscellaneous shrubs-----	5
Mc: McLain-----	Heavy Bottomland 080AY0450K	5,500	3,700	2,500	switchgrass-----	15
					blue grama-----	10
					meadow dropseed-----	10
					miscellaneous perennial grasses	10
					sideoats grama-----	10
					western wheatgrass-----	10
					Canada wildrye-----	5
					alkali sacaton-----	5
					buffalograss-----	5
					fourwing saltbush-----	5
					miscellaneous perennial forbs--	5
					prairie cordgrass-----	5
					vine mesquite-----	5

Rangeland Productivity and Characteristic Plant Communities—Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		Pct
MnD, MnF, MsB, MsC: Minco-----	Loamy Prairie 080AY056OK	5,500	3,850	2,750	little bluestem----- big bluestem----- switchgrass----- yellow indiagrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5
M-W. Miscellaneous water						
NaD: Nash-----	Loamy Prairie 080AY056OK	5,500	3,850	2,750	little bluestem----- big bluestem----- switchgrass----- yellow indiagrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5
Ironmound-----	Shallow Prairie 080AY083OK	3,000	2,100	1,500	little bluestem----- sideoats grama----- big bluestem----- blue grama----- miscellaneous perennial forbs-- miscellaneous perennial grasses buffalograss----- sand dropseed----- threeawn-----	30 15 10 10 10 10 5 5 5
NaD2, NaD3: Nash-----	Reseeded Loamy Prairie 080AY856OK	3,300	2,300	1,650	---	---
Ironmound-----	Reseeded Shallow Prairie 080AY883OK	2,000	1,400	1,000	---	---

Soil Survey of Canadian County, Oklahoma

Rangeland Productivity and Characteristic Plant Communities—Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		Pct
NrC: Noble-----	Sandy Savannah (west) 084AY0750K	4,500	3,300	2,500	little bluestem----- big bluestem----- miscellaneous perennial grasses miscellaneous trees----- Scribner panicum----- miscellaneous perennial forbs-- purpletop tridens----- sand lovegrass----- sideoats grama----- switchgrass----- yellow indiagrass-----	25 20 10 10 5 5 5 5 5 5 5
NrB, NrC, NrD: Norge-----	Loamy Prairie 080AY0560K	5,500	3,850	2,750	little bluestem----- big bluestem----- switchgrass----- yellow indiagrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5
PIT. Pits						
PkA, PkB: Pond Creek-----	Loamy Prairie 080AY0560K	5,500	3,850	2,750	little bluestem----- big bluestem----- switchgrass----- yellow indiagrass----- blue grama----- miscellaneous perennial forbs-- sideoats grama----- tall dropseed-----	25 20 10 10 5 5 5 5
PO, Pw: Port-----	Loamy Bottomland 080AY0500K	8,500	6,100	4,500	big bluestem----- miscellaneous perennial grasses switchgrass----- yellow indiagrass----- little bluestem----- miscellaneous perennial forbs-- eastern gramagrass----- miscellaneous trees-----	25 15 15 15 10 10 5 5

Rangeland Productivity and Characteristic Plant Communities—Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		
QdE: Ironmound-----	Shallow Prairie 080AY0830K	3,000	2,100	1,500	little bluestem-----	
					sideoats grama-----	30
					big bluestem-----	15
					blue grama-----	10
					miscellaneous perennial forbs--	10
					miscellaneous perennial grasses	10
					buffalograss-----	5
					sand dropseed-----	5
					threeawn-----	5
Dill-----	Sandy Prairie 080AY0730K	4,500	3,200	2,000	little bluestem-----	30
					big bluestem-----	25
					switchgrass-----	10
					yellow indiagrass-----	10
					blue grama-----	5
					sand sagebrush-----	5
					sideoats grama-----	5
					sand lovegrass-----	3
					skunkbush sumac-----	2
QrF: Ironmound-----	Shallow Prairie 080AY0830K	3,000	2,100	1,500	little bluestem-----	30
					sideoats grama-----	15
					big bluestem-----	10
					blue grama-----	10
					miscellaneous perennial forbs--	10
					miscellaneous perennial grasses	10
					buffalograss-----	5
					sand dropseed-----	5
					threeawn-----	5
Rock outcrop. Ra: Reinach-----	Loamy Bottomland 080AY0500K	8,500	6,100	4,500	big bluestem-----	25
					miscellaneous perennial grasses	15
					switchgrass-----	15
					yellow indiagrass-----	15
					little bluestem-----	10
					miscellaneous perennial forbs--	10
					eastern gramagrass-----	5
					miscellaneous trees-----	5

Soil Survey of Canadian County, Oklahoma

Rangeland Productivity and Characteristic Plant Communities—Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		Pct
RbA, RbB: Renfrow-----	Claypan Prairie (north) 080AY0100K	4,000	2,800	2,000	little bluestem----- big bluestem----- switchgrass----- yellow indiagrass----- blue grama----- buffalograss----- sideoats grama-----	25 20 15 10 5 5 5
RcC2: Renfrow-----	Reseeded Claypan Prairie 080AY8100K	3,300	2,300	1,600	---	---
ShB, ShC, ShD: Lovedale-----	Sandy Prairie 080AY0730K	4,500	3,200	2,000	little bluestem----- big bluestem----- switchgrass----- yellow indiagrass----- blue grama----- sand sagebrush----- sideoats grama----- sand lovegrass----- skunkbush sumac-----	30 25 10 10 5 5 5 3 2
ShD2: Lovedale-----	Reseeded Sandy Prairie 080AY8730K	2,650	2,000	1,300	---	---
SnE: Lovedale-----	Sandy Prairie 080AY0730K	4,500	3,200	2,000	little bluestem----- big bluestem----- switchgrass----- yellow indiagrass----- blue grama----- sand sagebrush----- sideoats grama----- sand lovegrass----- skunkbush sumac-----	30 25 10 10 5 5 5 3 2
Wisby-----	Sandy Prairie 080AY0730K	4,500	3,200	2,000	little bluestem----- big bluestem----- switchgrass----- yellow indiagrass----- blue grama----- sand sagebrush----- sideoats grama----- sand lovegrass----- skunkbush sumac-----	30 25 10 10 5 5 5 3 2

Rangeland Productivity and Characteristic Plant Communities—Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation		Composition
		Favorable year	Normal year	Unfavorable year			
		Lb/acre	Lb/acre	Lb/acre			Pct
Tv: Goodnight----- Dune 080AY022OK		3,600	2,700	1,800	little bluestem-----		30
					sand bluestem-----		20
					switchgrass-----		15
					miscellaneous perennial forbs--		10
					miscellaneous perennial grasses		10
					prairie sandreed-----		10
					Texas bluegrass-----		5
					miscellaneous shrubs-----		3
					miscellaneous trees-----		2
VeC: Grainola----- Claypan Prairie (north) 080AY010OK		4,000	2,800	2,000	little bluestem-----		25
					big bluestem-----		20
					switchgrass-----		15
					yellow indiagrass-----		10
					blue grama-----		5
					buffalograss-----		5
					sideoats grama-----		5
VrE: Grainola----- Claypan Prairie (north) 080AY010OK		4,000	2,800	2,000	little bluestem-----		25
					big bluestem-----		20
					switchgrass-----		15
					yellow indiagrass-----		10
					blue grama-----		5
					buffalograss-----		5
					sideoats grama-----		5
Vsc2: Grainola----- Reseeded Claypan Prairie 080AY810OK		3,300	2,300	1,600	little bluestem-----		25
					big bluestem-----		20
					switchgrass-----		15
					yellow indiagrass-----		10
					blue grama-----		5
					buffalograss-----		5
					sideoats grama-----		5
W. Water							

Rangeland Productivity and Characteristic Plant Communities—Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		Pct
Wa: Watonga----- Heavy Bottomland 080AY045OK		5,500	3,700	2,500	switchgrass-----	15
					blue grama-----	10
					meadow dropseed-----	10
					miscellaneous perennial grasses	10
					sidecoats grama-----	10
					western wheatgrass-----	10
					Canada wildrye-----	5
					alkali sacaton-----	5
					buffalograss-----	5
					fourwing saltbush-----	5
					miscellaneous perennial forbs--	5
					prairie cordgrass-----	5
					vine mesquite-----	5
Ya: Yahola----- Loamy Bottomland 080AY050OK		8,500	6,100	4,500	big bluestem-----	25
					miscellaneous perennial grasses	15
					switchgrass-----	15
					yellow indiagrass-----	15
					little bluestem-----	10
					miscellaneous perennial forbs--	10
					eastern gramagrass-----	5
					miscellaneous trees-----	5

Similarity Index

Similarity index indicates, by percentages ranging from 1 to 100, the extent to which the present plant community resembles a certain vegetative state on an ecological site. The Natural Resources Conservation Service uses similarity index in two ways.

A similarity index can be used to compare the present vegetation on an ecological site to the presumed historic vegetation for that site. This comparison provides a basis for ascertaining the extent and direction of changes that have differentiated the current vegetation from the historic vegetation. A similarity index of 70 would suggest that the present plant community has 70 percent of the presumed historic plant community for the site.

The management goal for rangeland, however, is not necessarily a present plant community that has a similarity index of 100 when compared to the historic plant community. A similarity index can also be used as a measure of how near the current plant community is to the goal of the landowner, that is, the percentage of the present plant community that resembles a desired plant community.

Abnormal disturbances that change the natural plant community include repeated overuse by livestock, excessive burning, erosion, and cultivation. Grazing animals select the most palatable plants. These plants will eventually die if they are continually grazed at a severity that does not allow for recovery. A very severe disturbance can completely destroy the natural community. Under these conditions, the less desirable plants, such as annuals and weed-like plants, can increase in abundance. If the plant community and the soils have not deteriorated significantly, the plant community can eventually return to predominantly natural plants if proper grazing management is applied.

Knowledge of the ecological site is necessary as a basis for planning and applying the management needed to maintain or improve the desired plant community for selected uses. Such information is needed to support or maintain management objectives, planned grazing systems, proper stocking rates, suitable wildlife management practices, recreational uses, and the condition of watersheds.

Rangeland Management

Rangeland management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the similarity index.

Effective range management conserves rainfall, enhances water quality, reduces the hazard of downstream flooding, improves yields, provides forage for livestock and wildlife, enhances recreational opportunities, and protects the soil. The main management concern is recognizing important changes in the plant cover or the range trend. These changes take place gradually and may be overlooked.

Each range manager should evaluate the type of plant community that best supports the ranch and then apply management and ecological principles to achieve the goals. The desired plant community should be within the capabilities of the land.

The primary range management practices used in Canadian County include prescribed grazing, stock-water developments, and fences. If undesirable plants become dominant, range seeding, brush management, or prescribed burning are commonly used.

Range management includes four major considerations:

1. *Proper grazing distribution*, which is achieved by managing livestock so that all parts of the grazing unit are grazed equally.
2. *Selective grazing*, which occurs because animals graze preferred plants to balance their diets. If selective grazing occurs repeatedly, the preferred plants are damaged.

3. *A proper stocking rate*, which is achieved by balancing animal numbers with forage production.

4. *Rest periods* during which grazed plants are given enough rest to recover and to maintain their growth.

It is important to remember that forage production is controlled by rainfall while composition is determined by grazing management.

Setting the stocking rate is not an exact science because there are influences from grazing management systems, season of use, mix of livestock, and seasonal forage production. Some rules of thumb, however, can be helpful. To maintain a nutritional cover of plants, about 50 percent of the annual growth of the key, or most important, grazing plants should remain at the end of the grazing season. Plants can be removed not only through grazing by livestock but also through grazing by rodents, insects, and wildlife and through the deterioration caused by climatic variations. Because of these factors, a safe initial stocking rate for livestock should be calculated on the basis of 25 percent of the total annual growth, by weight, of the vegetation.

For example, production could be 3,500 pounds per acre of air-dry grasses, forbs, and limited woody species during an average season on a Loamy Prairie ecological site where the similarity between the present plant community and the historic plant community is more than 70 percent. Twenty-five percent of this is 875 pounds per acre.

A 1,000-pound cow and her calf is equivalent to one animal unit (AU) and will consume about 2.6 percent of her body weight (26 pounds) of forage per day. Therefore, in one month, an animal unit will consume 790 pounds of native vegetation, depending on the quality and stage of growth of the plants (26 pounds per day times 365 days per year divided by 12 months per year).

Dividing 875 pounds (forage allocation) by 26 pounds (forage required per day for one animal unit) suggests that 1 acre of Loamy Prairie ecological site with a similarity index of 70 will feed one cow for 33.6 days. To convert forage available from 1 acre to animal unit month (AUM), the available forage (875 pounds) is divided by the amount required to feed an animal unit for 1 month (790 pounds). One acre will provide 1.1 AUM of grazing. Therefore, 10.9 acres will feed one cow for 12 months in this example. Another approach is to calculate the annual forage needs of an animal unit (790 pounds per month times 12 months equals 9,490 pounds). Dividing the 875 pounds of usable forage per acre into the 9,490 pounds needed by the cow reveals that approximately 10.9 acres is needed for one cow annually. Stocking rate calculation should be adjusted for animal size, grazing system, and grazing season.

More information about planning a grazing program is available at the local office of the Natural Resources Conservation Service.

Ecological Sites

The following paragraphs describe the ecological sites in Canadian County and list the plants that are characteristic of each site. Detailed ecological site descriptions are available at the local office of the Natural Resources Conservation Service.

078CY073OK, Sandy Prairie.—The dominant plants on this site are sand bluestem, little bluestem, indianguass, and switchgrass. They make up 75 percent of the vegetation. Others plants include sideoats grama and blue grama. Sand dropseed is a common invader.

080AY0100K, Claypan Prairie (north).—This site is in areas of nearly level to gently sloping, deep, loamy upland soils. These soils have a dense clayey subsoil that absorbs water slowly and restricts root penetration. Under good management, the important plants are little bluestem, switchgrass, leadplant, and perennial sunflowers. If the site is continually abused, sideoats grama, blue grama, tall dropseed, wild alfalfa, and buckbrush increase in abundance. Forage production is moderate.

080AY022OK, Dune.—This site is in areas of deep, strongly sloping to steep, sandy upland soils. The surface topography consists of choppy high dunes with narrow valleys between the dunes. Careful grazing management is needed to prevent blowouts. Under good management, the important plants are sand bluestem, little bluestem, giant sandreed, and sand lovegrass. If the site is continually abused, Texas bluegrass, sand paspalum, sandlily, bush morningglory, and skunkbush increase in abundance. Forage production is low.

080AY045OK, Heavy Bottomland.—This site is in areas of nearly level and very gently sloping, deep, clayey flood plain soils. These soils absorb water slowly. Large cracks in the soil are common during periods of drought. Under good management, the important plants are big bluestem, indiangrass, prairie cordgrass, switchgrass, and perennial sunflowers. If the site is continually abused, tall dropseed, goldenrod, sedges, and persimmon increase in abundance. Forage production is moderate.

080AY056OK, Loamy Prairie.—The climax vegetation is primarily little bluestem, big bluestem, indiangrass, and switchgrass. In combination with Canada wildrye, these plants represent about 70 percent of the site's vegetation. Under continuous heavy grazing, the principal grasses are sideoats grama and blue grama. Leadplant, wildindigo, scurfpea, and prairie acacia are common legumes.

080AY073OK, Sandy Prairie.—This site is in areas of very gently sloping to undulating, deep, moderately sandy upland soils that are highly productive and have a moderate water-holding capacity, which is good for root development and moisture storage. Under good management, the important plants are sand bluestem, little bluestem, and indiangrass. If the site is continually abused, sideoats grama, blue grama, and sand dropseed increase in abundance.

080AY083OK, Shallow Prairie.—The potential plant community is a tall grass range. Species composition, by weight, is 75 percent grasses, 20 percent forbs, and 5 percent woody plants. Big bluestem, indiangrass, switchgrass, little bluestem, tephrosia, catchlaw sensitivebrier, perennial sunflowers, and skunkbush are preferred plants and make up 65 percent of livestock forage production when the site is in excellent condition. Under continuous heavy grazing, these plants are replaced by less palatable plants, such as dropseed, jointtail, Scribner panicum, buffalograss, wildindigo, milkweeds, sagewort, sumacs, and indigobush. As the site deteriorates, other plants, such as broomsedge bluestem, splitbeard, Japanese brome, showy partridgepea, common broomweed, ragweeds, bitter sneezeweed, crotons, persimmon, and hawthorn dominate the site.

080AY091OK, Slickspot.—This site is in areas of gently sloping, deep, loamy upland soils that have a clayey, alkali subsoil with blocky structure. Forage production is low due to the slow intake of water, salt content, and poor aeration of the soil. Under good management, the important plants are alkali sacaton, switchgrass, western wheatgrass, tall dropseed, white tridens, and blue grama. These plants make up 50 percent of the vegetation. Other plants include dotted gayfeather, whorled dropseed, gummy lovegrass, fall witchgrass, yellow neptunia, mourning lovegrass, purple threeawn, curlycup gumweed, goldenweed, and hairy goldaster. If the site is abused, blue grama, silver bluestem, wild alfalfa, lanceleaf ragweed, threeawn, and western ragweed increase in abundance.

080AY095OK, Subirrigated.—This site is in areas of deep, nearly level and very gently sloping, sandy upland or flood plain soils. These soils have a high water table that is beneficial to plant growth. This site is highly productive. Under good management, the important plants are switchgrass, big bluestem, indiangrass, and eastern gamagrass. If the site is abused, tall dropseed, sideoats grama, sedges, willow, and cottonwood increase in abundance.

080AY097OK, Subirrigated (saline).—This site is in areas of deep, level, loamy, low terrace or flood plain soils that are strongly affected by salinity. Salinity restricts the selection and production of plants. These soils have a high water table, which is

beneficial to plants. Under good management, the important plants are switchgrass, western wheatgrass, vine mesquite, prairie cordgrass, and perennial sunflowers. If the site is continually abused, alkali sacaton, tall dropseed, inland saltgrass, willow, and baccharis increase in abundance.

080AY810OK, Reseeded Claypan Prairie.—This site is formerly cultivated land that is typically seeded to sideoats grama, blue grama, little bluestem, sand bluestem, and indiagrass. The site may have been damaged by erosion and has low inherent fertility. If the site is abused, broomweeds and threeawn will dominate.

080AY856OK, Reseeded Loamy Prairie.—The plant cover on this site includes big bluestem, switchgrass, little bluestem, indiagrass, and other seeded species. Native legumes can be abundant. Other important grasses include jointtail, meadow dropseed, tall dropseed, and hairy grama. Forage production is much lower than that of the Loamy Prairie site because of soil health destruction.

080AY873OK, Reseeded Sandy Prairie.—Reseeded species on this site primarily include little bluestem, big bluestem, indiagrass, and switchgrass. Other species include sideoats grama. Site production is limited by soil fertility due to prior cultivation. If the site is not carefully managed, ragweeds, threeawns, and other annuals will dominate.

080AY883OK, Reseeded Shallow Prairie.—Seeded grasses on this site include sideoats grama and native bluestem mixes. If the site is abused, hairy grama, buffalograss, dropseed, silver bluestem, cheat grass, broomweed, western ragweed, and other weedy grasses and forbs dominate. Because of past use and erosion, this site is not productive.

084AY018OK, Deep Sand Savannah.—This site is in areas of very gently sloping to moderately steep, deep, sandy upland soils. Under good management, the important plants consist of an overstory of post oak and blackjack oak with an understory of big bluestem, sand lovegrass, and switchgrass. The trees can occur in thick stands and scattered stands. As trees thicken, herbaceous vegetation decreases in abundance. If the site is abused, tall dropseed, purpletop, Scribner panicum, heath aster, white snakeroot, splitbeard bluestem, broomsedge bluestem, winged elm, hickory, buckbrush, sumac, and shrubby oak increase in abundance. Eastern redcedar can increase in abundance if the site is not subject to fires.

084AY075OK, Sandy Savannah (west).—This site is in areas of deep, gently sloping to steep, moderately productive, loamy upland soils. Under good management, the important plants consist of a scattered stand of post oak and blackjack oak with little bluestem, big bluestem, indiagrass, perennial sunflowers, and perennial lespedezas. If the site is continually abused, poison ivy, tall dropseed, sideoats grama, Scribner panicum, purpletop, and heath aster increase in abundance. Woody vegetation makes up approximately 10 to 15 percent of the total vegetation.

084AY076OK, Sandy Savannah (central).—The decreaser grasses on this site are little bluestem, indiagrass, big bluestem, and switchgrass and compose at least 45 percent of the total vegetation. Canada wildrye, Virginia wildrye, Texas bluegrass, and flatsedge are the cool-season species. Woody species include post oak, blackjack oak, hickory, ash, elm, bumelia, coralberry, persimmon, poison ivy, grape, and hackberry. These species should not exceed 20 percent of the total vegetative cover.

084AY088OK, Shallow Savannah.—This site consists of a mid to tall grass savannah. Little bluestem, sand bluestem, and sideoats grama are the more important grasses. Sideoats grama is important on the very shallow spots. The decreaser grasses and legumes make up about 50 percent of the climax vegetation. The principal legumes are tall lespedeza, roundhead lespedeza, Virginia tephrosia, and prairie-clover. Post oak, blackjack oak, and associated woody species represent about 10 percent of the climax vegetation. Buckeye, a common woody shrub which is sometimes poisonous to livestock, occurs on this site.

084AY876OK, Reseeded Sandy Savannah.—This site is former cropland that is typically seeded to a mixture of big bluestem, little bluestem, indiangrass, switchgrass, sideoats grama, and other grasses. If the land is abused, these grasses are replaced by red lovegrass, gummy lovegrass, dropseed, Scribner panicum, fall witchgrass, wild buckwheat, ragweed, and sandbur.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Windbreaks are often planted on land that did not originally support trees. Knowledge of how trees perform on such land can be gained only by observing and recording the performance of trees that have been planted and have survived. Many popular windbreak species are not indigenous to the areas in which they are planted.

Each tree or shrub species has certain climatic and physiographic limits. Within these parameters, a tree or shrub may grow well or grow poorly, depending on the characteristics of the soil. Each tree or shrub has definable potential heights in a given physiographic area and under given climatic conditions. Accurate definitions of potential heights are necessary when a windbreak is planned and designed.

The table “Windbreaks and Environmental Plantings” shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in this table are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from the local office of the Natural Resources Conservation Service or Cooperative Extension Service or from a nursery.

Windbreaks and Environmental Plantings

(Absence of an entry indicates that trees generally do not grow to the given height)

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
BeA: Bethany-----	Amur honeysuckle	American plum, eastern redcedar	Austrian pine, osageorange, ponderosa pine, green ash, red mulberry, black locust	---	---
BnC: Binger-----	---	---	---	Austrian pine, eastern redcedar	shortleaf pine, loblolly pine, eastern cottonwood
Br: Brewer-----	---	American plum	---	eastern redcedar, osageorange, bur oak, shortleaf pine	green ash, American sycamore, eastern cottonwood
Bu: Brewer-----	---	American plum	---	eastern redcedar, osageorange, bur oak, shortleaf pine	green ash, American sycamore, eastern cottonwood
Drummond.					
Ca: Canadian-----	---	---	eastern redcedar, ponderosa pine, red mulberry	bur oak, green ash, osageorange, black locust	eastern cottonwood
Da: Dale-----	---	---	eastern redcedar, red mulberry	bur oak, green ash, osageorange, black locust	eastern cottonwood
DAM. Large dam					
DnD, DnF: Darnell.					
Noble-----	---	American plum, Amur honeysuckle	eastern redcedar, oriental arborvitae, red mulberry	Austrian pine, Chinese elm, black locust, green ash	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--			
	<8	8-15	16-25	26-35
DuD: Dill-----	---	---	Austrian pine, eastern redcedar, ponderosa pine, red mulberry	loblolly pine eastern cottonwood
Ironmound.				
DUM. Dumps				
Ga, Gb. Gracemore				
GdB, GdC, GdC2, GdB, GdD3: Konawa-----	---	American plum, Amur honeysuckle	eastern redcedar, oriental arborvitae, red mulberry	Austrian pine, Chinese elm, black locust, green ash ---
GhB: Grant-----	---	American plum, Amur honeysuckle	eastern redcedar, oriental arborvitae, Austrian pine, green ash, osageorange, ponderosa pine	Chinese elm, black locust ---
Pawhuska.				
GpE: Grant-----	---	American plum, Amur honeysuckle	eastern redcedar, oriental arborvitae, Austrian pine, green ash, osageorange, ponderosa pine	Chinese elm, black locust ---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
GuD, GuD2: Grant-----	---	American plum, Amur honeysuckle	eastern redcedar, oriental arborvitae, Austrian pine, green ash, osageorange, ponderosa pine	Chinese elm, black locust	---
Ironmound.					
KfB, KfC: Kingfisher-----	Amur honeysuckle	red mulberry	Austrian pine, black locust, eastern redcedar, green ash, osageorange, ponderosa pine	---	---
KrA, KrB: Kirkland-----	Amur honeysuckle	American plum, eastern redcedar	Austrian pine, osageorange, ponderosa pine, green ash, red mulberry, black locust	---	---
KSb: Kirkland-----	Amur honeysuckle	American plum, eastern redcedar	Austrian pine, osageorange, ponderosa pine, green ash, red mulberry, black locust	---	---
Pawhuska.					

Windbreaks and Environmental Plantings-Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
KwD: Konawa-----	---	American plum, Amur honeysuckle	eastern redcedar, oriental arborvitae, red mulberry	Austrian pine, Chinese elm, black locust, green ash	---
Mc: McLain-----	Amur honeysuckle	American plum, eastern redcedar	Austrian pine, osageorange, ponderosa pine, green ash, red mulberry, black locust	---	---
MnD, MnF, MsB, MsC: Minco-----	---	American plum, Amur honeysuckle	eastern redcedar, oriental arborvitae, Austrian pine, green ash, osageorange, ponderosa pine	Chinese elm, black locust	---
M-W. Miscellaneous water					
NaD, NaD2. Nash-Ironmound					
NaD3: Nash.					
Ironmound-----	common lilac, Amur honeysuckle	oriental arborvitae, eastern redcedar, osageorange	---	---	---
NbC: Noble-----	---	American plum, Amur honeysuckle	eastern redcedar, oriental arborvitae, red mulberry	Austrian pine, Chinese elm, black locust, green ash	---

Windbreaks and Environmental Plantings—Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
NrB, NrC, NrD: Norge-----	---	American plum, Amur honeysuckle	eastern redcedar, oriental arborvitae, Austrian pine, green ash, osageorange, ponderosa pine	Chinese elm, black locust	---
PIT. Pits					
PkA, PkB: Pond Creek-----	skunkbush sumac	common lilac, American plum, Amur honeysuckle	---	Austrian pine, eastern redcedar, osageorange, red mulberry	Chinese elm
Po, Pw: Port-----	skunkbush sumac	common lilac, American plum, Amur honeysuckle	---	Austrian pine, eastern redcedar	green ash, osageorange, red mulberry, Chinese elm, American sycamore, eastern cottonwood
QdE: Ironmound.					
Dill-----	---	---	Austrian pine, eastern redcedar, ponderosa pine, red mulberry	loblolly pine	eastern cottonwood
QrF. Ironmound-Rock outcrop					
Ra: Reinach-----	---	---	eastern redcedar, ponderosa pine, red mulberry	bur oak, green ash, osageorange	eastern cottonwood

Windbreaks and Environmental Plantings—Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
RbA, RbB, RcC2: Renfrow-----	---	American plum, Amur honeysuckle, eastern redcedar	Austrian pine, black locust, osageorange, ponderosa pine, green ash, red mulberry	---	---
ShB, ShC, ShD, ShD2: Lovedale-----	---	Amur honeysuckle	eastern redcedar, oriental arborvitae, red mulberry, Austrian pine, green ash, ponderosa pine	black locust	---
SnE: Lovedale-----	---	Amur honeysuckle	eastern redcedar, oriental arborvitae, red mulberry, Austrian pine, green ash, ponderosa pine	black locust	---
Wisby-----	Amur honeysuckle	Austrian pine, red mulberry	black locust, eastern redcedar, green ash, osageorange, ponderosa pine	---	---
Tv: Goodnight-----	---	eastern redcedar, oriental arborvitae	Austrian pine, ponderosa pine	---	---
VeC: Grainola-----	---	---	Austrian pine, black locust, osageorange, ponderosa pine, red mulberry	---	---

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
VrE: Grainola-----	---	---	Austrian pine, black locust, osageorange, ponderosa pine, red mulberry	---	---
Rock outcrop.					
VsC2: Grainola-----	---	---	Austrian pine, black locust, osageorange, ponderosa pine, red mulberry	---	---
W. Water					
Wa: Watonga-----	Amur honeysuckle	eastern redcedar, green ash	Austrian pine, black locust, osageorange, ponderosa pine, red mulberry	---	---
Ya: Yahola-----	---	---	eastern redcedar, ponderosa pine, red mulberry	bur oak, green ash, osageorange, black locust	eastern cottonwood



Figure 12.—A watershed lake with waterfowl.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. If food, cover, or water is missing, inadequate, or inaccessible, wildlife will be scarce or will not inhabit the area.

The table “Wildlife Habitat” shows the soils that have potential for habitat development. Wildlife habitat can be created or improved by planting appropriate vegetation, properly managing the existing plant cover, and fostering the natural establishment of desirable plants (fig. 12).

Elements of Wildlife Habitat

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants used by wildlife. Examples are wheat, rye, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes planted for wildlife food and cover. Examples are fescue, brome grass, timothy, orchardgrass, clover, alfalfa, trefoil, reed canarygrass, and crownvetch.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestem, indiagrass, blueberry, goldenrod, lambsquarters, dandelions, blackberry, ragweed, wheatgrass, fescue, and nightshade.

The major soil properties affecting the growth of grain and forage crops and wild herbaceous plants are depth of the root zone, texture of the surface layer, the amount of water available to plants, wetness, salinity or sodicity, and flooding. The length of the growing season also is important.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountainmahogany, bitterbrush, snowberry, and big sagebrush.

The major soil properties affecting the growth of hardwood and coniferous trees and

shrubs are depth of the root zone, the amount of water available to plants, and wetness.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Wetland plants produce food or cover for wetland wildlife. Examples of these plants are smartweed, wild millet, rushes, sedges, bulrushes, wild rice, arrowhead, waterplantain, pickerelweed, and cattail.

The major soil properties affecting wetland plants are texture of the surface layer, wetness, acidity or alkalinity, and slope.

Shallow water areas have an average depth of less than 5 feet. They are useful as habitat for some wildlife species. They are naturally wet areas or are created by dams, levees, or water-control measures in marshes or streams. Examples are muskrat marshes, waterfowl feeding areas, wildlife watering developments, beaver ponds, and other wildlife ponds.

The major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability.

Kinds of Wildlife Habitat

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, and shrubs. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include Hungarian partridge, pheasant, sharp-tailed grouse, sage grouse, meadowlark, field sparrow, killdeer, cottontail rabbit, and red fox.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas that support water-tolerant plants. The wildlife attracted to this habitat include ducks, geese, herons, bitterns, rails, kingfishers, muskrat, otter, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. The wildlife attracted to rangeland includes antelope, deer, sage grouse, meadowlark, and lark bunting.

Soil Survey of Canadian County, Oklahoma

Wildlife Habitat

(See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Potential for habitat elements						Potential as habitat for		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wetland wild- life	Range- land wild- life
BeA: Bethany-----	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair
BnC: Binger-----	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair
Br: Brewer-----	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair
Bu: Brewer-----	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair
Drummond-----	Poor	Fair	Fair	Poor	Fair	Fair	Fair	Fair	Poor
Ca: Canadian-----	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
Da: Dale-----	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair
DAM. Large dam									
DnD: Darnell-----	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair
Noble-----	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good
DnF: Darnell-----	Very poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair
Noble-----	Poor	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Fair
DuD: Dill-----	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair
Ironmound-----	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor
DUM. Dumps									
Ga: Gracemore-----	Fair	Fair	Good	Good	Fair	Fair	Fair	Fair	Good
Gb: Gracemore-----	Poor	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair

Soil Survey of Canadian County, Oklahoma

Wildlife Habitat—Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wetland wild- life	Range- land wild- life
GdB, GdC, GdC2: Konawa-----	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good
GdD, GdD3: Konawa-----	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good
GhB: Grant-----	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair
Pawhuska-----	Poor	Poor	Very poor	Poor	Very poor	Poor	Poor	Very poor	Very poor
GpE: Grant-----	Fair	Good	Good	Fair	Very poor	Very poor	Good	Very poor	Fair
Port-----	Poor	Fair	Fair	Good	Poor	Very poor	Fair	Very poor	Fair
GuD, GuD2: Grant-----	Fair	Good	Good	Fair	Very poor	Very poor	Good	Very poor	Fair
Ironmound-----	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor
KfB, KfC: Kingfisher-----	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair
KrA, KrB: Kirkland-----	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair
KsB: Kirkland-----	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair
Pawhuska-----	Poor	Poor	Very poor	Poor	Very poor	Poor	Poor	Very poor	Very poor
KwD: Konawa-----	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good
Mc: McLain-----	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair
MnD: Minco-----	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
MnF: Minco-----	Poor	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Fair

Soil Survey of Canadian County, Oklahoma

Wildlife Habitat—Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wetland wild- life	Range- land wild- life
MsB, MsC: Minco-----	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
M-W. Miscellaneous water									
NaD, NaD2, NaD3: Nash-----	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair
Ironmound-----	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor
NbC: Noble-----	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
NrB, NrC: Norge-----	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair
NrD: Norge-----	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair
PIT. Pits									
PkA, PkB: Pond Creek-----	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair
Po: Port-----	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good
Pw: Port-----	Poor	Fair	Fair	Good	Poor	Very poor	Fair	Very poor	Fair
QdE: Ironmound-----	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor
Dill-----	Fair	Good	Good	Fair	Very poor	Very poor	Good	Very poor	Fair
QrF: Ironmound-----	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor
Rock outcrop.									
Ra: Reinach-----	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good

Soil Survey of Canadian County, Oklahoma

Wildlife Habitat—Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wetland wild- life	Range- land wild- life
RbA, RbB: Renfrow-----	Good	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair
RcC2: Renfrow-----	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair
ShB, ShC: Lovedale-----	Good	Good	Good	---	Fair	Very poor	Fair	Poor	Good
ShD, ShD2: Lovedale-----	Fair	Good	Good	---	Fair	Very poor	Fair	Very poor	Good
SnE: Lovedale-----	Fair	Fair	Good	---	Fair	Very poor	Fair	Very poor	Good
Wisby-----	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair
Tv: Goodnight-----	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair
VeC: Grainola-----	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair
VrE: Grainola-----	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair
Rock outcrop.									
VsC2: Grainola-----	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair
W. Water									
Wa: Watonga-----	Fair	Fair	Poor	Fair	Poor	Poor	Fair	Poor	Fair
Ya: Yahola-----	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good

Recreation

The soils of the survey area are rated in the table “Recreational Development” according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites, and either access to public sewer lines or the capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degrees, for recreational uses by the duration of flooding and the season when it occurs. Onsite assessment of the height, duration, intensity, and frequency of flooding is essential in planning recreational facilities.

Camp areas are tracts of land used intensively as sites for tents, trailers, and campers and for outdoor activities that accompany such sites. These areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The soils are rated on the basis of soil properties that influence the ease of developing camp areas and performance of the areas after development. Also considered are the soil properties that influence trafficability and promote the growth of vegetation after heavy use.

Picnic areas are natural or landscaped tracts of land that are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The soils are rated on the basis of soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation after development. The surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Playgrounds are areas used intensively for baseball, football, or similar activities. These areas require a nearly level soil that is free of stones and that can withstand heavy foot traffic and maintain an adequate cover of vegetation. The soils are rated on the basis of soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation. Slope and stoniness are the main concerns in developing playgrounds. The surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Paths and trails are areas used for hiking and horseback riding. The areas should require little or no cutting and filling during site preparation. The soils are rated on the basis of soil properties that influence trafficability and erodibility. Paths and trails should remain firm under foot traffic and not be dusty when dry.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

The interpretive ratings in this table help engineers, planners, and others to understand how soil properties influence recreational uses. Ratings for proposed uses are given in terms of limitations. Only the most restrictive features are listed. Other features may limit a specific recreational use.

The degree of soil limitation is expressed as slight, moderate, or severe.

Slight means that soil properties are favorable for the rated use. The limitations are minor and can be easily overcome. Good performance and low maintenance are expected.

Moderate means that soil properties are moderately favorable for the rated use. The limitations can be overcome or modified by special planning, design, or maintenance.

During some part of the year, the expected performance may be less desirable than that of soils rated slight.

Severe means that soil properties are unfavorable for the rated use. Examples of limitations are slope, bedrock near the surface, flooding, and a seasonal high water table. These limitations generally require major soil reclamation, special design, or intensive maintenance. Overcoming the limitations generally is difficult and costly.

The information in the table "Recreational Development" can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in the table "Building Site Development" and interpretations for septic tank absorption fields in the table "Sanitary Facilities."

Soil Survey of Canadian County, Oklahoma

Recreational Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table.
Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
BeA: Bethany-----	Slight	Slight	Slight	Slight	Slight
BnC: Binger-----	Slight	Slight	Moderate: slope depth to rock	Slight	Moderate: depth to rock
Br: Brewer-----	Severe: flooding	Slight	Slight	Slight	Slight
Bu: Brewer-----	Severe: flooding	Slight	Slight	Slight	Slight
Drummond-----	Severe: excess sodium excess salt flooding	Severe: excess sodium excess salt	Severe: excess sodium excess salt	Slight	Severe: excess sodium excess salt
Ca: Canadian-----	Severe: flooding	Slight	Slight	Slight	Slight
Da: Dale-----	Severe: flooding	Slight	Slight	Slight	Slight
DAM. Large dam					
DnD: Darnell-----	Severe: depth to rock	Severe: depth to rock	Severe: slope depth to rock	Slight	Severe: depth to rock
Noble-----	Moderate: slope	Moderate: slope	Severe: slope	Slight	Moderate: slope
DnF: Darnell-----	Severe: slope depth to rock	Severe: slope depth to rock	Severe: slope depth to rock	Moderate: slope	Severe: slope depth to rock
Noble-----	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope
DuD: Dill-----	Slight	Slight	Severe: slope	Slight	Moderate: depth to rock
Ironmound-----	Severe: depth to rock	Severe: depth to rock	Severe: slope depth to rock	Slight	Severe: depth to rock
DUM. Dumps					

Soil Survey of Canadian County, Oklahoma

Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ga: Gracemore-----	Severe: flooding wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness droughty
Gb: Gracemore-----	Severe: flooding wetness	Severe: wetness	Severe: flooding wetness	Severe: wetness	Severe: flooding wetness droughty
GdB, GdC, GdC2: Konawa-----	Slight	Slight	Moderate: slope	Slight	Slight
GdD: Konawa-----	Slight	Slight	Severe: slope	Slight	Slight
GdD3: Konawa-----	Slight	Slight	Moderate: slope	Slight	Slight
GhB: Grant-----	Slight	Slight	Moderate: slope	Severe: erodes easily	Slight
Pawhuska-----	Severe: excess sodium excess salt	Severe: excess sodium excess salt	Severe: excess sodium excess salt	Slight	Severe: excess sodium excess salt
GpE: Grant-----	Moderate: slope	Moderate: slope	Severe: slope	Severe: erodes easily	Moderate: slope
Port-----	Severe: flooding	Moderate: flooding	Severe: flooding	Moderate: flooding	Severe: flooding
GuD: Grant-----	Slight	Slight	Severe: slope	Severe: erodes easily	Slight
Ironmound-----	Severe: depth to rock	Severe: depth to rock	Severe: slope depth to rock	Slight	Severe: depth to rock
GuD2: Grant-----	Slight	Slight	Moderate: slope	Severe: erodes easily	Slight
Ironmound-----	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Slight	Severe: depth to rock
KfB, KfC: Kingfisher-----	Slight	Slight	Moderate: slope depth to rock	Severe: erodes easily	Moderate: depth to rock
KrA: Kirkland-----	Moderate: percs slowly	Moderate: percs slowly	Moderate: percs slowly	Slight	Slight

Soil Survey of Canadian County, Oklahoma

Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
KrB: Kirkland-----	Moderate: percs slowly	Moderate: percs slowly	Moderate: percs slowly slope	Slight	Slight
KsB: Kirkland-----	Moderate: percs slowly	Moderate: percs slowly	Moderate: percs slowly	Slight	Slight
Pawhuska-----	Severe: excess sodium excess salt	Severe: excess sodium excess salt	Severe: excess sodium excess salt	Slight	Severe: excess sodium excess salt
KwD: Konawa-----	Slight	Slight	Moderate: slope	Slight	Slight
Mc: McLain-----	Severe: flooding	Slight	Slight	Slight	Slight
MnD: Minco-----	Slight	Slight	Severe: slope	Severe: erodes easily	Slight
MnF: Minco-----	Severe: slope	Severe: slope	Severe: slope	Severe: erodes easily	Severe: slope
MsB, MsC: Minco-----	Slight	Slight	Moderate: slope	Severe: erodes easily	Slight
M-W. Miscellaneous water					
NaD, NaD2, NaD3: Nash-----	Slight	Slight	Moderate: slope depth to rock	Severe: erodes easily	Moderate: depth to rock
Ironmound-----	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Slight	Severe: depth to rock
NbC: Noble-----	Slight	Slight	Moderate: slope	Slight	Slight
NrB, NrC: Norge-----	Slight	Slight	Moderate: slope	Slight	Slight
NrD: Norge-----	Slight	Slight	Severe: slope	Slight	Slight
PIT. Pits					
PkA: Pond Creek-----	Slight	Slight	Slight	Slight	Slight

Soil Survey of Canadian County, Oklahoma

Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
PkB: Pond Creek-----	Slight	Slight	Moderate: slope	Slight	Slight
Po: Port-----	Severe: flooding	Slight	Moderate: flooding	Slight	Moderate: flooding
Pw: Port-----	Severe: flooding	Moderate: flooding	Severe: flooding	Moderate: flooding	Severe: flooding
QdE: Ironmound-----	Severe: depth to rock	Severe: depth to rock	Severe: slope depth to rock	Slight	Severe: depth to rock
Dill-----	Moderate: slope	Moderate: slope	Severe: slope	Slight	Moderate: slope depth to rock
QrF: Ironmound-----	Severe: slope depth to rock	Severe: slope depth to rock	Severe: slope depth to rock	Moderate: slope	Severe: slope depth to rock
Rock outcrop.					
Ra: Reinach-----	Severe: flooding	Slight	Slight	Slight	Slight
RbA: Renfrow-----	Moderate: percs slowly	Moderate: percs slowly	Moderate: percs slowly	Slight	Slight
RbB, RcC2: Renfrow-----	Moderate: percs slowly	Moderate: percs slowly	Moderate: percs slowly slope	Slight	Slight
ShB, ShC: Lovedale-----	Slight	Slight	Moderate: slope	Slight	Slight
ShD, ShD2: Lovedale-----	Slight	Slight	Severe: slope	Slight	Slight
SnE: Lovedale-----	Moderate: slope	Moderate: slope	Severe: slope	Slight	Moderate: slope
Wisby-----	Moderate: slope	Moderate: slope	Severe: slope	Slight	Moderate: slope droughty
Tv: Goodnight-----	Severe: too sandy	Severe: too sandy	Severe: slope too sandy	Severe: too sandy	Severe: droughty

Soil Survey of Canadian County, Oklahoma

Recreational Development—Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
VeC: Grainola-----	Slight	Slight	Moderate: slope small stones depth to rock	Severe: erodes easily	Moderate: large stones depth to rock
VrE: Grainola-----	Moderate: slope	Moderate: slope	Severe: slope	Severe: erodes easily	Moderate: large stones slope depth to rock
Rock outcrop.					
VsC2: Grainola-----	Slight	Slight	Moderate: slope small stones depth to rock	Severe: erodes easily	Moderate: large stones depth to rock
W. Water					
Wa: Watonga-----	Severe: flooding	Moderate: percs slowly too clayey	Moderate: percs slowly too clayey	Moderate: too clayey	Severe: too clayey
Ya: Yahola-----	Severe: flooding	Slight	Moderate: flooding	Slight	Moderate: flooding

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for sanitary facilities, waste management, building site development, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the “Soil Properties” section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Sanitary Facilities

The table “Sanitary Facilities” shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. It also shows the suitability of the soils for use as a daily cover for landfill.

Soil properties are important in selecting sites for sanitary facilities and in identifying limiting soil properties and site features to be considered in planning, design, and installation. Soil limitation ratings of slight, moderate, or severe are given for septic

tank absorption fields, sewage lagoons, and trench and area sanitary landfills. Soil suitability ratings of good, fair, and poor are given for daily cover for landfill.

A rating of *slight* or *good* indicates that the soils have no limitations or that the limitations can be easily overcome. Good performance and low maintenance can be expected. A rating of *moderate* or *fair* indicates that the limitations should be recognized but generally can be overcome by good management or special design. A rating of *severe* or *poor* indicates that overcoming the limitations is difficult or impractical. Increased maintenance may be required.

Septic tank absorption fields are areas in which subsurface systems of tile or perforated pipe distribute effluent from a septic tank into the natural soil. The centerline of the tile is assumed to be at a depth of 24 inches. Only the part of the soil between depths of 24 and 60 inches is considered in making the ratings. The soil properties and site features considered are those that affect the absorption of the effluent, those that affect the construction and maintenance of the system, and those that may affect public health.

The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow or excessively rapid absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted, relatively impervious soil material. Aerobic lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Relatively impervious soil material for the lagoon floor and sides is desirable to minimize seepage and contamination of local ground water.

The table "Sanitary Facilities" gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Trench sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil that is excavated from the trench. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. Soil properties that influence the risk of pollution, the ease of excavation, trafficability, and revegetation are the major considerations in rating the soils.

Area sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil that is imported from a source away from the site.

A final cover of soil at least 2 feet thick is placed over the completed landfill. Soil properties that influence trafficability, revegetation, and the risk of pollution are the main considerations in rating the soils for area sanitary landfills.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. The ratings in the table "Sanitary Facilities" are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste. The suitability of a soil for use as cover is based on properties that affect workability and the ease of digging, moving, and spreading the material over the refuse daily during both wet and dry periods.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Soil Survey of Canadian County, Oklahoma

Sanitary Facilities

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BeA: Bethany-----	Severe: percs slowly	Moderate: seepage	Severe: too clayey	Slight	Poor: hard to pack too clayey
BnC: Binger-----	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Poor: depth to rock
Br: Brewer-----	Severe: percs slowly	Slight	Severe: too clayey	Moderate: flooding	Poor: hard to pack too clayey
Bu: Brewer-----	Severe: percs slowly	Slight	Severe: too clayey	Moderate: flooding	Poor: hard to pack too clayey
Drummond-----	Severe: percs slowly wetness	Severe: seepage	Severe: seepage wetness	Severe: seepage wetness	Poor: excess sodium
Ca: Canadian-----	Moderate: flooding	Severe: seepage	Severe: seepage	Severe: seepage	Good
Da: Dale-----	Moderate: flooding percs slowly	Moderate: seepage	Moderate: flooding too clayey	Moderate: flooding	Fair: too clayey
DAM. Large dam					
DnD: Darnell-----	Severe: depth to rock	Severe: seepage slope depth to rock	Severe: seepage depth to rock	Severe: depth to rock	Poor: depth to rock
Noble-----	Moderate: slope	Severe: seepage slope	Severe: seepage	Severe: seepage	Fair: slope
DnF: Darnell-----	Severe: slope depth to rock	Severe: seepage slope depth to rock	Severe: seepage slope depth to rock	Severe: slope depth to rock	Poor: slope depth to rock
Noble-----	Severe: slope	Severe: seepage slope	Severe: seepage slope	Severe: seepage slope	Poor: slope

Soil Survey of Canadian County, Oklahoma

Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
DuD: Dill-----	Severe: depth to rock	Severe: seepage depth to rock	Severe: seepage depth to rock	Severe: seepage depth to rock	Poor: depth to rock
Ironmound-----	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Poor: depth to rock
DUM. Dumps					
Ga, Gb: Gracemore-----	Severe: flooding wetness poor filter	Severe: flooding seepage wetness	Severe: flooding seepage wetness	Severe: flooding seepage wetness	Poor: seepage too sandy wetness
GdB, GdC, GdC2, GdD, GdD3: Konawa-----	Moderate: percs slowly	Severe: seepage	Severe: seepage	Severe: seepage	Good
GhB: Grant-----	Moderate: percs slowly depth to rock	Moderate: seepage slope depth to rock	Severe: depth to rock	Moderate: depth to rock	Fair: too clayey depth to rock
Pawhuska-----	Severe: percs slowly	Moderate: slope	Severe: excess sodium too clayey	Slight	Poor: excess sodium hard to pack too clayey
GpE: Grant-----	Moderate: percs slowly slope depth to rock	Severe: slope	Severe: depth to rock	Moderate: slope depth to rock	Fair: slope too clayey depth to rock
Port-----	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Fair: too clayey
GuD, GuD2: Grant-----	Moderate: percs slowly depth to rock	Moderate: seepage slope depth to rock	Severe: depth to rock	Moderate: depth to rock	Fair: too clayey depth to rock
Ironmound-----	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Poor: depth to rock
KfB, KfC: Kingfisher-----	Severe: percs slowly depth to rock	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Poor: depth to rock
KrA: Kirkland-----	Severe: percs slowly	Slight	Severe: too clayey depth to rock	Slight	Poor: hard to pack too clayey

Soil Survey of Canadian County, Oklahoma

Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
KrB: Kirkland-----	Severe: percs slowly	Moderate: slope	Severe: too clayey depth to rock	Slight	Poor: hard to pack too clayey
KsB: Kirkland-----	Severe: percs slowly	Slight	Severe: too clayey depth to rock	Slight	Poor: hard to pack too clayey
Pawhuska-----	Severe: percs slowly	Slight	Severe: excess sodium too clayey	Slight	Poor: excess sodium hard to pack too clayey
KwD: Konawa-----	Moderate: percs slowly	Severe: seepage	Severe: seepage	Severe: seepage	Good
Mc: McLain-----	Severe: percs slowly	Slight	Moderate: flooding too clayey	Moderate: flooding	Poor: hard to pack
MnD: Minco-----	Moderate: percs slowly	Moderate: seepage slope	Slight	Slight	Good
MnF: Minco-----	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope
MsB, MsC: Minco-----	Moderate: percs slowly	Moderate: seepage slope	Slight	Slight	Good
M-W. Miscellaneous water					
NaD, NaD2, NaD3: Nash-----	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Poor: depth to rock
Ironmound-----	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Poor: depth to rock
NbC: Noble-----	Slight	Severe: seepage	Severe: seepage	Severe: seepage	Good
NrB, NrC, NrD: Norge-----	Severe: percs slowly	Moderate: seepage slope	Moderate: too clayey	Slight	Fair: thin layer too clayey
PIT. Pits					

Soil Survey of Canadian County, Oklahoma

Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
PkA: Pond Creek-----	Severe: percs slowly	Slight	Moderate: too clayey	Slight	Fair: too clayey
PkB: Pond Creek-----	Severe: percs slowly	Moderate: slope	Moderate: too clayey	Slight	Fair: too clayey
Po, Pw: Port-----	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Fair: too clayey
QdE: Ironmound-----	Severe: depth to rock	Severe: slope depth to rock	Severe: depth to rock	Severe: depth to rock	Poor: depth to rock
Dill-----	Severe: depth to rock	Severe: seepage slope depth to rock	Severe: seepage depth to rock	Severe: seepage depth to rock	Poor: depth to rock
QrF: Ironmound-----	Severe: slope depth to rock	Severe: slope depth to rock	Severe: slope depth to rock	Severe: slope depth to rock	Poor: slope depth to rock
Rock outcrop.					
Ra: Reinach-----	Moderate: flooding percs slowly	Moderate: seepage	Moderate: flooding	Moderate: flooding	Good
RbA: Renfrow-----	Severe: percs slowly	Slight	Severe: too clayey	Slight	Poor: hard to pack too clayey
RbB, RcC2: Renfrow-----	Severe: percs slowly	Moderate: slope	Severe: too clayey	Slight	Poor: hard to pack too clayey
ShB, ShC, ShD, ShD2: Lovedale-----	Moderate: percs slowly	Severe: seepage	Severe: seepage	Slight	Fair: thin layer
SnE: Lovedale-----	Moderate: percs slowly slope	Severe: seepage slope	Severe: seepage	Moderate: slope	Fair: slope thin layer
Wisby-----	Severe: poor filter	Severe: seepage slope	Severe: seepage too sandy	Severe: seepage	Poor: seepage small stones too sandy

Soil Survey of Canadian County, Oklahoma

Sanitary Facilities—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Tv: Goodnight-----	Severe: poor filter	Severe: seepage slope	Severe: seepage too sandy	Severe: seepage	Poor: seepage too sandy
VeC: Grainola-----	Severe: percs slowly depth to rock	Severe: depth to rock	Severe: too clayey depth to rock	Severe: depth to rock	Poor: hard to pack too clayey depth to rock
VrE: Grainola-----	Severe: percs slowly depth to rock	Severe: slope depth to rock	Severe: too clayey depth to rock	Severe: depth to rock	Poor: hard to pack too clayey depth to rock
Rock outcrop.					
VsC2: Grainola-----	Severe: percs slowly depth to rock	Severe: depth to rock	Severe: too clayey depth to rock	Severe: depth to rock	Poor: hard to pack too clayey depth to rock
W. Water					
Wa: Watonga-----	Severe: percs slowly	Slight	Severe: too clayey	Moderate: flooding	Poor: hard to pack too clayey
Ya: Yahola-----	Severe: flooding	Severe: flooding seepage	Severe: flooding seepage	Severe: flooding seepage	Good

Building Site Development

The table "Building Site Development" shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered slight if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; moderate if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and severe if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, potential for frost action, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 60 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
BeA: Bethany-----	Moderate: too clayey	Severe: shrink-swell	Severe: shrink-swell	Severe: shrink-swell	Severe: low strength shrink-swell	Slight
BnC: Binger-----	Moderate: dense layer depth to rock	Slight	Moderate: depth to rock	Moderate: slope	Slight	Moderate: depth to rock
Br: Brewer-----	Moderate: too clayey	Severe: flooding shrink-swell	Severe: flooding shrink-swell	Severe: flooding shrink-swell	Severe: low strength shrink-swell	Slight
Bu: Brewer-----	Moderate: too clayey	Severe: flooding shrink-swell	Severe: flooding shrink-swell	Severe: flooding shrink-swell	Severe: low strength shrink-swell	Slight
Drummond-----	Severe: wetness	Severe: flooding shrink-swell	Severe: flooding wetness	Severe: flooding shrink-swell	Severe: low strength shrink-swell	Severe: excess sodium excess salt
Ca: Canadian-----	Severe: cutbanks cave	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding	Slight
Da: Dale-----	Slight	Severe: flooding	Severe: flooding	Severe: flooding	Severe: low strength	Slight
DAM. Large dam						
DnD: Darnell-----	Severe: depth to rock	Moderate: slope depth to rock	Severe: depth to rock	Severe: slope	Moderate: slope depth to rock	Severe: depth to rock
Noble-----	Moderate: slope	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
DnF: Darnell-----	Severe: slope depth to rock	Severe: slope	Severe: slope depth to rock	Severe: slope	Severe: slope	Severe: slope depth to rock
Noble-----	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
DuD: Dill-----	Moderate: dense layer depth to rock	Slight	Moderate: depth to rock	Moderate: slope	Slight	Moderate: depth to rock
Ironmound-----	Severe: depth to rock	Moderate: depth to rock	Severe: depth to rock	Moderate: slope depth to rock	Moderate: depth to rock	Severe: depth to rock
DUM. Dumps						
Ga: Gracemore-----	Severe: wetness cutbanks cave	Severe: flooding wetness	Severe: flooding wetness	Severe: flooding wetness	Severe: flooding wetness	Severe: wetness droughty
Gb: Gracemore-----	Severe: wetness cutbanks cave	Severe: flooding wetness	Severe: flooding wetness	Severe: flooding wetness	Severe: flooding wetness	Severe: flooding wetness droughty
GdB: Konawa-----	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Slight
GdC, GdC2, GdD, GdD3: Konawa-----	Severe: cutbanks cave	Slight	Slight	Moderate: slope	Slight	Slight
GhB: Grant-----	Moderate: dense layer	Slight	Slight	Slight	Severe: low strength	Slight
Pawhuska-----	Moderate: too clayey	Severe: shrink-swell	Severe: shrink-swell	Severe: shrink-swell	Severe: low strength shrink-swell	Severe: excess sodium excess salt

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
GpE: Grant-----	Moderate: slope dense layer	Moderate: slope	Moderate: slope	Severe: slope	Severe: low strength	Moderate: slope
Port-----	Moderate: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding
GuD, GuD2: Grant-----	Moderate: dense layer	Slight	Slight	Moderate: slope	Severe: low strength	Slight
Ironmound-----	Severe: depth to rock	Moderate: depth to rock	Severe: depth to rock	Moderate: slope depth to rock	Moderate: depth to rock	Severe: depth to rock
KfB: Kingfisher-----	Moderate: too clayey dense layer depth to rock	Moderate: shrink-swell	Moderate: shrink-swell depth to rock	Moderate: shrink-swell	Severe: low strength	Moderate: depth to rock
KfC: Kingfisher-----	Moderate: too clayey dense layer depth to rock	Moderate: shrink-swell	Moderate: shrink-swell depth to rock	Moderate: shrink-swell slope	Severe: low strength	Moderate: depth to rock
KrA, KrB: Kirkland-----	Moderate: too clayey	Severe: shrink-swell	Severe: shrink-swell	Severe: shrink-swell	Severe: low strength shrink-swell	Slight
KsB: Kirkland-----	Moderate: too clayey	Severe: shrink-swell	Severe: shrink-swell	Severe: shrink-swell	Severe: low strength shrink-swell	Slight
Pawhuska-----	Moderate: too clayey	Severe: shrink-swell	Severe: shrink-swell	Severe: shrink-swell	Severe: low strength shrink-swell	Severe: excess sodium excess salt
KwD: Konawa-----	Severe: cutbanks cave	Slight	Slight	Moderate: slope	Slight	Slight

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Mc: McLain-----	Moderate: too clayey	Severe: flooding shrink-swell	Severe: flooding shrink-swell	Severe: flooding shrink-swell	Severe: low strength shrink-swell	Slight
MnD: Minco-----	Slight	Slight	Slight	Moderate: slope	Slight	Slight
MnF: Minco-----	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
MsB: Minco-----	Slight	Slight	Slight	Slight	Slight	Slight
MsC: Minco-----	Slight	Slight	Slight	Moderate: slope	Slight	Slight
M-W. Miscellaneous water						
NaD, NaD2, NaD3: Nash-----	Moderate: dense layer depth to rock	Slight	Moderate: depth to rock	Moderate: slope	Slight	Moderate: depth to rock
Ironmound-----	Severe: depth to rock	Moderate: depth to rock	Severe: depth to rock	Moderate: slope depth to rock	Moderate: depth to rock	Severe: depth to rock
NbC: Noble-----	Slight	Slight	Slight	Moderate: slope	Slight	Slight
NrB: Norge-----	Moderate: too clayey	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell	Severe: low strength	Slight
NrC, NrD: Norge-----	Moderate: too clayey	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell slope	Severe: low strength	Slight
PIT. Pits						

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
PkA, PkB: Pond Creek-----	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell	Severe: low strength	Slight
Po: Port-----	Moderate: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding
Pw: Port-----	Moderate: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding low strength	Severe: flooding
QdE: Ironmound-----	Severe: depth to rock	Moderate: slope depth to rock	Severe: depth to rock	Severe: slope	Moderate: slope depth to rock	Severe: depth to rock
Dill-----	Moderate: slope dense layer depth to rock	Moderate: slope	Moderate: slope depth to rock	Severe: slope	Moderate: slope	Moderate: slope depth to rock
QrF: Ironmound-----	Severe: slope depth to rock	Severe: slope	Severe: slope depth to rock	Severe: slope	Severe: slope	Severe: slope depth to rock
Rock outcrop.						
Ra: Reinach-----	Slight	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding	Slight
RbA, RbB, RcC2: Renfrow-----	Moderate: too clayey	Severe: shrink-swell	Severe: shrink-swell	Severe: shrink-swell	Severe: low strength shrink-swell	Slight
ShB: Lovedale-----	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Slight
ShC, ShD, ShD2: Lovedale-----	Severe: cutbanks cave	Slight	Slight	Moderate: slope	Slight	Slight

Soil Survey of Canadian County, Oklahoma

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
SnE: Lovedale-----	Severe: cutbanks cave	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope
Wisby-----	Severe: cutbanks cave	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope droughty
Tv: Goodnight-----	Severe: cutbanks cave	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope	Severe: droughty
VeC: Grainola-----	Moderate: too clayey depth to rock	Severe: shrink-swell	Severe: shrink-swell	Severe: shrink-swell	Severe: low strength shrink-swell	Moderate: large stones depth to rock
VrE: Grainola-----	Moderate: slope too clayey depth to rock	Severe: shrink-swell	Severe: shrink-swell	Severe: shrink-swell slope	Severe: low strength shrink-swell	Moderate: large stones slope depth to rock
Rock outcrop.						
VsC2: Grainola-----	Moderate: too clayey depth to rock	Severe: shrink-swell	Severe: shrink-swell	Severe: shrink-swell	Severe: low strength shrink-swell	Moderate: large stones depth to rock
W. Water						
Wa: Watonga-----	Severe: cutbanks cave	Severe: flooding shrink-swell	Severe: flooding shrink-swell	Severe: flooding shrink-swell	Severe: low strength shrink-swell	Severe: too clayey
Ya: Yahola-----	Severe: cutbanks cave	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding

Construction Materials

The table "Construction Materials" gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated good, fair, or poor as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In the table "Construction Materials," the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated good contain significant amounts of sand or gravel or both. They have at least 6 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated fair are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated poor have one or more of the following characteristics: a plasticity index of more than 10, a high shrink-swell potential, many stones, slopes of more than 25 percent, or a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In the table "Construction Materials," only the probability of finding material in suitable quantity in or below the soil is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable

material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated good have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated fair are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated poor are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Soil Survey of Canadian County, Oklahoma

Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
BeA: Bethany-----	Poor: low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Poor: too clayey
BnC: Binger-----	Poor: depth to rock	Improbable: excess fines	Improbable: excess fines	Fair: area reclaim too clayey depth to rock
Br: Brewer-----	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Poor: too clayey
Bu: Brewer-----	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Poor: too clayey
Drummond-----	Fair: wetness	Improbable: excess fines	Improbable: excess fines	Poor: excess sodium excess salt too clayey
Ca: Canadian-----	Good	Improbable: excess fines	Improbable: excess fines	Good
Da: Dale-----	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Good
DAM. Large dam				
DnD: Darnell-----	Poor: depth to rock	Improbable: excess fines	Improbable: excess fines	Poor: area reclaim small stones depth to rock
Noble-----	Good	Improbable: excess fines	Improbable: excess fines	Fair: slope
DnF: Darnell-----	Poor: depth to rock	Improbable: excess fines	Improbable: excess fines	Poor: area reclaim small stones depth to rock
Noble-----	Fair: slope	Improbable: excess fines	Improbable: excess fines	Poor: slope
DuD: Dill-----	Poor: depth to rock	Improbable: excess fines	Improbable: excess fines	Fair: area reclaim thin layer depth to rock

Soil Survey of Canadian County, Oklahoma

Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
DuD: Ironmound-----	Poor: depth to rock	Improbable: excess fines	Improbable: excess fines	Poor: area reclaim depth to rock
DUM. Dumps				
Ga, Gb: Gracemore-----	Poor: wetness	Probable	Improbable: too sandy	Poor: too sandy wetness
GdB, GdC, GdC2, GdD, GdD3: Konawa-----	Good	Improbable: excess fines	Improbable: excess fines	Poor: thin layer
GhB: Grant-----	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
Pawhuska-----	Poor: low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Poor: excess sodium excess salt too clayey
GpE: Grant-----	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: slope too clayey
Port-----	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Good
GuD, GuD2: Grant-----	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
Ironmound-----	Poor: depth to rock	Improbable: excess fines	Improbable: excess fines	Poor: area reclaim depth to rock
KfB, KfC: Kingfisher-----	Poor: low strength depth to rock	Improbable: excess fines	Improbable: excess fines	Fair: area reclaim thin layer depth to rock
KrA, KrB: Kirkland-----	Poor: low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Poor: too clayey
KsB: Kirkland-----	Poor: low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Poor: too clayey
Pawhuska-----	Poor: low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Poor: excess sodium excess salt too clayey

Soil Survey of Canadian County, Oklahoma

Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
KwD: Konawa-----	Good	Improbable: excess fines	Improbable: excess fines	Poor: thin layer
Mc: McLain-----	Poor: low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Poor: too clayey
MnD: Minco-----	Good	Improbable: excess fines	Improbable: excess fines	Good
MnF: Minco-----	Fair: slope	Improbable: excess fines	Improbable: excess fines	Poor: slope
MsB, MsC: Minco-----	Good	Improbable: excess fines	Improbable: excess fines	Good
M-W. Miscellaneous water				
NaD, NaD2, NaD3: Nash-----	Poor: depth to rock	Improbable: excess fines	Improbable: excess fines	Fair: area reclaim depth to rock
Ironmound-----	Poor: depth to rock	Improbable: excess fines	Improbable: excess fines	Poor: area reclaim depth to rock
NbC: Noble-----	Good	Improbable: excess fines	Improbable: excess fines	Good
NrB, NrC, NrD: Norge-----	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
PIT. Pits				
PkA, PkB: Pond Creek-----	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
Po: Port-----	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Good
Pw: Port-----	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey

Soil Survey of Canadian County, Oklahoma

Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
QdE: Ironmound-----	Poor: depth to rock	Improbable: excess fines	Improbable: excess fines	Poor: area reclaim depth to rock
Dill-----	Poor: depth to rock	Improbable: excess fines	Improbable: excess fines	Fair: area reclaim thin layer depth to rock
QrF: Ironmound-----	Poor: depth to rock	Improbable: excess fines	Improbable: excess fines	Poor: area reclaim slope depth to rock
Rock outcrop.				
Ra: Reinach-----	Good	Improbable: excess fines	Improbable: excess fines	Good
RbA, RbB, RcC2: Renfrow-----	Poor: low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Poor: too clayey
ShB, ShC, ShD, ShD2: Lovedale-----	Good	Probable	Improbable: too sandy	Fair: small stones too clayey
SnE: Lovedale-----	Good	Probable	Improbable: too sandy	Fair: slope small stones too clayey
Wisby-----	Good	Probable	Improbable: too sandy	Poor: area reclaim small stones too sandy
Tv: Goodnight-----	Good	Probable	Improbable: too sandy	Poor: too sandy
VeC: Grainola-----	Poor: low strength shrink-swell depth to rock	Improbable: excess fines	Improbable: excess fines	Poor: too clayey
VrE: Grainola-----	Poor: low strength shrink-swell depth to rock	Improbable: excess fines	Improbable: excess fines	Poor: too clayey
Rock outcrop.				

Soil Survey of Canadian County, Oklahoma

Construction Materials—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
VsC2: Grainola-----	Poor: low strength shrink-swell depth to rock	Improbable: excess fines	Improbable: excess fines	Poor: too clayey
W. Water				
Wa: Watonga-----	Poor: low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Poor: too clayey
Ya: Yahola-----	Good	Improbable: excess fines	Improbable: excess fines	Good

Water Management

The table "Water Management" gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In the table "Water Management," the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even more than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties. Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving.

The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, and sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is



Figure 13.—Wheat on Norge silt loam, 1 to 3 percent slopes, and a constructed waterway on Grant-Pawhuska complex, 1 to 3 percent slopes.

affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity (fig. 13). Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts and sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
BeA: Bethany-----	Slight	Moderate: hard to pack	Severe: no water	Limitation: deep to water	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly
BnC: Binger-----	Moderate: seepage slope depth to rock	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing depth to rock	Limitation: soil blowing depth to rock	Limitation: rooting depth depth to rock
Br: Brewer-----	Slight	Moderate: hard to pack	Severe: no water	Limitation: deep to water	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly
Bu: Brewer-----	Slight	Moderate: hard to pack	Severe: no water	Limitation: deep to water	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly
Drummond-----	Severe: seepage	Severe: excess sodium piping	Severe: slow refill	Limitation: excess salt percs slowly	Limitation: wetness droughty	Limitation: erodes easily wetness	Limitation: erodes easily excess sodium excess salt
Ca: Canadian-----	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: soil blowing	Limitation: soil blowing	Favorable
Da: Dale-----	Moderate: seepage	Moderate: piping	Severe: no water	Limitation: deep to water	Limitation: erodes easily	Limitation: erodes easily	Limitation: erodes easily
DAM. Large dam							

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
DnD, DnF: Darnell-----	Severe: slope depth to rock	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing depth to rock	Limitation: slope soil blowing depth to rock	Limitation: rooting depth slope depth to rock
Noble-----	Severe: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing	Limitation: slope soil blowing	Limitation: slope
DuD: Dill-----	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing	Limitation: slope soil blowing	Limitation: depth to rock
Ironmound----	Severe: depth to rock	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing depth to rock	Limitation: slope soil blowing depth to rock	Limitation: rooting depth slope depth to rock
DUM. Dumps							
Ga, Gb: Gracemore----	Severe: seepage	Severe: seepage piping wetness	Severe: cutbanks cave	Limitation: flooding cutbanks cave	Limitation: fast intake wetness droughty	Limitation: too sandy wetness soil blowing	Limitation: wetness droughty
GdB: Konawa-----	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: soil blowing	Limitation: soil blowing	Limitation: rooting depth
GdC, GdC2, GdD, GdD3: Konawa-----	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing	Limitation: soil blowing	Limitation: rooting depth
GhB: Grant-----	Moderate: seepage depth to rock	Moderate: piping thin layer	Severe: no water	Limitation: deep to water	Limitation: erodes easily	Limitation: erodes easily	Limitation: erodes easily
Pawhuska-----	Slight	Severe: excess sodium	Severe: no water	Limitation: deep to water	Limitation: percs slowly droughty	Limitation: erodes easily percs slowly	Limitation: erodes easily excess sodium excess salt

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
GpE: Grant-----	Severe: slope	Moderate: piping thin layer	Severe: no water	Limitation: deep to water	Limitation: erodes easily slope	Limitation: erodes easily slope	Limitation: erodes easily slope
Port-----	Moderate: seepage	Moderate: piping	Severe: no water	Limitation: deep to water	Limitation: flooding	Limitation: erodes easily	Limitation: erodes easily
GuD, GuD2: Grant-----	Moderate: seepage slope depth to rock	Moderate: piping thin layer	Severe: no water	Limitation: deep to water	Limitation: erodes easily slope	Limitation: erodes easily	Limitation: erodes easily
Ironmound----	Severe: depth to rock	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope depth to rock	Limitation: depth to rock	Limitation: rooting depth depth to rock
KfB: Kingfisher---	Moderate: depth to rock	Severe: thin layer	Severe: no water	Limitation: deep to water	Limitation: rooting depth depth to rock	Limitation: erodes easily depth to rock	Limitation: erodes easily depth to rock
KfC: Kingfisher---	Moderate: slope depth to rock	Severe: thin layer	Severe: no water	Limitation: deep to water	Limitation: rooting depth slope depth to rock	Limitation: erodes easily depth to rock	Limitation: erodes easily depth to rock
KrA, KrB: Kirkland-----	Slight	Severe: hard to pack	Severe: no water	Limitation: deep to water	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly
KsB: Kirkland-----	Slight	Severe: hard to pack	Severe: no water	Limitation: deep to water	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly
Pawhuska-----	Slight	Severe: excess sodium	Severe: no water	Limitation: deep to water	Limitation: percs slowly droughty	Limitation: erodes easily percs slowly	Limitation: erodes easily excess sodium excess salt
KwD: Konawa-----	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing	Limitation: soil blowing	Limitation: rooting depth

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Mc: McLain-----	Slight	Moderate: hard to pack piping	Severe: no water	Limitation: deep to water	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly
MnD: Minco-----	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: erodes easily slope soil blowing	Limitation: erodes easily soil blowing	Limitation: erodes easily
MnF: Minco-----	Severe: slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: erodes easily slope soil blowing	Limitation: erodes easily slope soil blowing	Limitation: erodes easily slope
MsB: Minco-----	Moderate: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: erodes easily	Limitation: erodes easily	Limitation: erodes easily
MsC: Minco-----	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: erodes easily slope	Limitation: erodes easily	Limitation: erodes easily
M-W. Miscellaneous water							
NaD, NaD2, NaD3: Nash-----	Moderate: seepage slope depth to rock	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope depth to rock	Limitation: erodes easily depth to rock	Limitation: erodes easily depth to rock
Ironmound----	Severe: depth to rock	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing depth to rock	Limitation: soil blowing depth to rock	Limitation: rooting depth depth to rock
NbC: Noble-----	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing	Limitation: soil blowing	Favorable

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
NrB: Norge-----	Slight	Moderate: piping	Severe: no water	Limitation: deep to water	Limitation: erodes easily	Limitation: erodes easily	Limitation: erodes easily
NrC, NrD: Norge-----	Moderate: slope	Moderate: piping	Severe: no water	Limitation: deep to water	Limitation: erodes easily slope	Limitation: erodes easily	Limitation: erodes easily
PIT. Pits							
PkA, PkB: Pond Creek---	Slight	Moderate: piping	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily
Po, Pw: Port-----	Moderate: seepage	Moderate: piping	Severe: no water	Limitation: deep to water	Limitation: flooding	Limitation: erodes easily	Limitation: erodes easily
QdE: Ironmound----	Severe: slope depth to rock	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope depth to rock	Limitation: slope depth to rock	Limitation: rooting depth slope depth to rock
Dill-----	Severe: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing depth to rock	Limitation: slope soil blowing depth to rock	Limitation: slope depth to rock
QrF: Ironmound----	Severe: slope depth to rock	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope depth to rock	Limitation: slope depth to rock	Limitation: rooting depth slope depth to rock
Rock outcrop.							
Ra: Reinach-----	Moderate: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: erodes easily soil blowing	Limitation: erodes easily soil blowing	Limitation: erodes easily

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
RbA, RbB: Renfrow-----	Slight	Moderate: hard to pack	Severe: no water	Limitation: deep to water	Limitation: percs slowly rooting depth	Limitation: erodes easily percs slowly rooting depth	Limitation: erodes easily percs slowly rooting depth
RcC2: Renfrow-----	Moderate: slope	Moderate: hard to pack	Severe: no water	Limitation: deep to water	Limitation: percs slowly rooting depth slope	Limitation: erodes easily percs slowly rooting depth	Limitation: erodes easily percs slowly rooting depth
ShB: Lovedale-----	Severe: seepage	Moderate: piping thin layer	Severe: no water	Limitation: deep to water	Limitation: soil blowing	Limitation: soil blowing	Favorable
ShC, ShD, ShD2: Lovedale----	Severe: seepage	Moderate: piping thin layer	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing	Limitation: soil blowing	Favorable
SnE: Lovedale-----	Severe: seepage slope	Moderate: piping thin layer	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing	Limitation: slope soil blowing	Limitation: slope
Wisby-----	Severe: seepage slope	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing droughty	Limitation: slope too sandy soil blowing	Limitation: slope droughty
Tv: Goodnight----	Severe: seepage slope	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: fast intake slope droughty	Limitation: slope too sandy soil blowing	Limitation: slope droughty
VeC: Grainola-----	Moderate: slope depth to rock	Moderate: hard to pack thin layer	Severe: no water	Limitation: deep to water	Limitation: percs slowly slope depth to rock	Limitation: erodes easily depth to rock	Limitation: erodes easily depth to rock

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
VrE: Grainola-----	Severe: slope	Moderate: hard to pack thin layer	Severe: no water	Limitation: deep to water	Limitation: percs slowly slope depth to rock	Limitation: erodes easily slope depth to rock	Limitation: erodes easily slope depth to rock
Rock outcrop.							
VsC2: Grainola-----	Moderate: slope depth to rock	Moderate: hard to pack thin layer	Severe: no water	Limitation: deep to water	Limitation: percs slowly slope depth to rock	Limitation: erodes easily depth to rock	Limitation: erodes easily depth to rock
W. Water							
Wa: Watonga-----	Slight	Severe: hard to pack	Severe: no water	Limitation: deep to water	Limitation: erodes easily percs slowly slow intake	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly
Ya: Yahola-----	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: flooding	Limitation: soil blowing	Favorable

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

The table "Engineering Index Properties" gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions in of this survey.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the system adopted by the American Association of State Highway and Transportation Officials (1) and the Unified soil classification system (2).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil

that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Engineering Index Properties

(Absence of an entry indicates that the data were not estimated)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
BeA: Bethany-----	0-14	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	80-98	21-37	2-13
	14-18	Silty clay loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-26
	18-60	Silty clay, clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	96-100	96-100	90-99	37-60	15-34
	60-80	Silty clay, clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	96-100	96-100	90-99	37-60	15-34
BnC: Binger-----	0-10	Fine sandy loam	SC-SM, SM	A-2, A-4	0	0	100	98-100	94-100	30-50	15-26	NP-7
	10-32	Fine sandy loam, sandy clay loam	CL, CL-ML, SC-SM, SC	A-4, A-6	0	0	90-100	83-100	75-100	36-65	20-35	6-15
	32-40	Weathered bedrock			---	---	---	---	---	---	---	---
Br: Brewer-----	0-12	Silty clay loam	CL	A-6, A-7	0	0	100	100	98-100	90-98	33-42	12-19
	12-64	Silty clay loam, silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-70	16-38
	64-84	Silty clay loam, loam, clay loam	CH, CL	A-4, A-7, A-6	0	0	100	100	96-100	80-98	30-70	8-38
Bu: Brewer-----	0-10	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	80-98	30-37	8-13
	10-64	Silty clay loam, silty clay, clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-70	16-38
	64-84	Silty clay loam, loam, clay loam	CH, CL	A-4, A-7, A-6	0	0	100	100	96-100	80-98	30-70	8-38

Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
Bu: Drummond-----	In										Pct	
	0-10	Loam	CL, ML, CL-ML	A-4, A-6	0	0	100	100	96-100	65-97	22-39	3-15
	10-30	Clay loam, silty clay loam, clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-98	35-60	15-35
	30-42	Clay loam, silty clay loam, clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-98	35-60	15-35
Ca: Canadian-----	42-62	Fine sandy loam	ML, CL-ML, SC-SM, SM	A-4	0	0	100	100	94-100	36-60	14-26	NP-7
	0-15	Fine sandy loam	ML, CL-ML, SC-SM, SM	A-4	0	0	100	100	94-100	36-60	14-26	NP-7
	15-26	Fine sandy loam, loam, sandy loam	ML, SC-SM, CL-ML, SM	A-4	0	0	100	100	94-100	36-85	14-29	NP-7
	26-60	Fine sandy loam, loam, loamy fine sand	ML, SC-SM, CL-ML, SM	A-3, A-2, A-4	0	0	100	100	82-100	5-85	0-29	NP-7
Da: Dale-----	0-24	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	70-97	22-31	8-14
	24-42	Silt loam, loam, silty clay loam	CL	A-4, A-7, A-6	0	0	100	100	96-100	65-98	30-43	8-20
	42-64	Silt loam, loam, silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	30-43	8-20
	DAM. Large dam											
DnD, DnF: Darnell-----	0-5	Fine sandy loam	CL-ML, SM, ML, SC-SM	A-2, A-4	0	0-15	90-100	88-100	83-100	30-60	0-26	NP-7
	5-11	Fine sandy loam, loam, gravelly fine sandy loam	ML, CL, SC, SM	A-2, A-4	0	0-10	70-100	70-100	60-100	25-60	15-30	NP-10
	11-15	Weathered bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	<u>In</u>				<u>Pct</u>	<u>Pct</u>					<u>Pct</u>	
DnD, DnF: Noble-----	0-10	Fine sandy loam	ML, CL-ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-60	15-26	NP-7
	10-72	Loam, very fine sandy loam, fine sandy loam	ML, CL-ML, SC-SM, SM	A-4	0	0	100	98-100	94-100	36-85	14-29	NP-7
DuD:												
Dill-----	0-12	Fine sandy loam	ML, CL-ML, SC-SM, SM	A-2, A-4	0	0	100	100	90-100	20-70	0-26	NP-7
	12-34	Fine sandy loam, very fine sandy loam, loam	CL-ML, SM, ML, SC-SM	A-2, A-4	0	0	98-100	95-100	90-100	20-70	0-26	NP-6
	34-42	Weathered bedrock			---	---	---	---	---	---	---	---
Ironmound-----	0-7	Fine sandy loam	ML, CL-ML, SC-SM, SM	A-2, A-4	0	0	85-100	85-100	80-100	30-60	14-26	NP-7
	7-12	Loam, fine sandy loam, clay loam	CL-ML, CL, ML	A-4, A-6	0	0	85-100	80-100	76-100	52-85	14-35	2-18
	12-60	Weathered bedrock			---	---	---	---	---	---	---	---
DUM. Dumps												
Ga: Gracemore-----	0-12	Loamy fine sand	SM	A-2	0	0	100	98-100	90-100	15-35	0-0	NP
	12-72	Fine sand, sandy loamy fine sand	SM, SP-SM	A-2, A-3	0	0	90-100	85-100	82-100	5-35	0-0	NP
Gb: Gracemore-----	0-10	Loamy fine sand	SM	A-2	0	0	100	98-100	90-100	15-35	0-0	NP
	10-72	Fine sand, sandy loamy fine sand	SM, SP-SM	A-2, A-3	0	0	90-100	85-100	82-100	5-35	0-0	NP

Soil Survey of Canadian County, Oklahoma

Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments			Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	Pct	4	10	40	200		
	<u>In</u>						<u>Pct</u>					<u>Pct</u>	
GdB, GdC: Konawa-----	0-7	Fine sandy loam	CL-ML, ML, SM, SC-SM	A-4	0	0	0	100	98-100	94-100	36-60	14-26	NP-7
	7-38	Sandy clay loam, fine sandy loam	ML, CL, SC, SM	A-4, A-6	0	0	0	100	98-100	90-100	36-65	14-37	NP-16
	38-60	Fine sandy loam, sandy clay loam, loamy fine sand	CL-ML, SM, ML, SC-SM	A-4, A-2, A-6	0	0	0	100	98-100	90-100	15-65	0-37	NP-16
GdC2: Konawa-----	0-5	Fine sandy loam	ML, CL-ML, SC-SM, SM	A-4	0	0	0	100	98-100	94-100	36-60	14-26	NP-7
	5-36	Sandy clay loam, fine sandy loam	ML, CL, SC, SM	A-4, A-6	0	0	0	100	98-100	90-100	36-65	14-37	NP-16
	36-60	Fine sandy loam, sandy clay loam, loamy fine sand	ML, CL-ML, SC-SM, SM	A-4, A-2, A-6	0	0	0	100	98-100	90-100	15-65	0-37	NP-16
GdD: Konawa-----	0-7	Fine sandy loam	CL-ML, SM, ML, SC-SM	A-4	0	0	0	100	98-100	94-100	36-60	14-26	NP-7
	7-38	Sandy clay loam, fine sandy loam	ML, CL, SC, SM	A-4, A-6	0	0	0	100	98-100	90-100	36-65	14-37	NP-16
	38-60	Fine sandy loam, sandy clay loam, loamy fine sand	CL-ML, SM, ML, SC-SM	A-4, A-2, A-6	0	0	0	100	98-100	90-100	15-65	0-37	NP-16
GdD3: Konawa-----	0-4	Fine sandy loam	CL-ML, SM, ML, SC-SM	A-4	0	0	0	100	98-100	94-100	36-60	14-26	NP-7
	4-35	Sandy clay loam, fine sandy loam	ML, CL, SC, SM	A-4, A-6	0	0	0	100	98-100	90-100	36-65	14-37	NP-16
	35-60	Fine sandy loam, sandy clay loam, loamy fine sand	CL-ML, SM, ML, SC-SM	A-4, A-2, A-6	0	0	0	100	98-100	90-100	15-65	0-37	NP-16

Soil Survey of Canadian County, Oklahoma

Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--					Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200			
	<u>In</u>				<u>Pct</u>	<u>Pct</u>						<u>Pct</u>	
GhB: Grant-----	0-10	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	30-37	8-14	
	10-18	Silt loam, loam, very fine sandy loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	90-100	51-90	20-32	1-10	
	18-46	Silt loam, loam, silty clay loam	CL	A-6, A-4, A-7	0	0	100	100	90-100	70-90	30-42	8-19	
	46-60	Silt loam, loam, very fine sandy loam	CL, CL-ML, ML	A-4	0	0	70-100	70-100	65-100	55-90	20-32	1-10	
	60-64	Weathered bedrock			---	---	---	---	---	---	---	---	
Pawhuska-----	0-8	Silt loam	CL-ML, ML	A-4	0	0	100	100	96-100	80-97	22-30	2-7	
	8-32	Silty clay loam, silty clay, clay	CH, CL	A-7	0	0	90-100	90-100	85-100	85-99	41-70	20-40	
	32-62	Silty clay loam, silty clay, clay	CH, CL	A-7	0	0	90-100	90-100	85-100	85-99	41-70	20-40	
	0-10	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	30-37	8-14	
	10-18	Silt loam, loam, very fine sandy loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	90-100	51-90	20-32	1-10	
GpE: Grant-----	18-46	Silt loam, loam, silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	90-100	70-90	30-42	8-19	
	46-60	Silt loam, loam, very fine sandy loam	CL, CL-ML, ML	A-4	0	0	70-100	70-100	65-100	55-90	20-32	1-10	
	60-64	Weathered bedrock			---	---	---	---	---	---	---	---	
	0-30	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14	
	30-50	Silty clay loam, clay loam, loam	CL	A-6, A-4, A-7	0	0	100	100	96-100	65-98	27-43	8-20	
Port-----	50-70	Silty clay loam, clay loam, loam	CL	A-6, A-4, A-7	0	0	100	100	96-100	65-98	27-43	8-20	

Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	<u>In</u>				<u>Pct</u>	<u>Pct</u>					<u>Pct</u>	
GuD: Grant-----	0-10	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	30-37	8-14
	10-18	Silt loam, loam, very fine sandy loam	CL, ML, CL-ML	A-4, A-6	0	0	100	100	90-100	51-90	20-32	1-10
	18-46	Silt loam, loam, silty clay loam	CL	A-4, A-6, A-7	0	0	100	100	90-100	70-90	30-42	8-19
	46-60	Silt loam, loam, very fine sandy loam	CL, ML, CL-ML	A-4	0	0	70-100	70-100	65-100	55-90	20-32	1-10
	60-64	Weathered bedrock			---	---	---	---	---	---	---	---
Ironmound-----	0-7	Loam	CL, CL-ML	A-4, A-6	0	0	85-100	85-100	76-100	52-97	24-35	4-13
	7-12	Loam, fine sandy loam, clay loam	CL, CL-ML, ML	A-4, A-6	0	0	85-100	80-100	76-100	52-85	14-35	2-18
	12-60	Weathered bedrock			---	---	---	---	---	---	---	---
GuD2: Grant-----	0-8	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	30-37	8-14
	8-16	Silt loam, loam, very fine sandy loam	CL, ML, CL-ML	A-4, A-6	0	0	100	100	90-100	51-90	20-32	1-10
	16-44	Silt loam, loam, silty clay loam	CL	A-4, A-7, A-6	0	0	100	100	90-100	70-90	30-42	8-19
	44-58	Silt loam, loam, very fine sandy loam	CL, CL-ML, ML	A-4	0	0	70-100	70-100	65-100	55-90	20-32	1-10
	58-62	Weathered bedrock			---	---	---	---	---	---	---	---
Ironmound-----	0-7	Loam	CL, CL-ML	A-4, A-6	0	0	85-100	85-100	76-100	52-97	24-35	4-13
	7-12	Loam, fine sandy loam, clay loam	CL, CL-ML, ML	A-4, A-6	0	0	85-100	80-100	76-100	52-85	14-35	2-18
	12-60	Weathered bedrock			---	---	---	---	---	---	---	---

Soil Survey of Canadian County, Oklahoma

Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index	
			Unified	AASHTO	>10 inches	3-10 inches		4	10	40			200
						Pct	Pct						
KfB, KfC: Kingfisher-----	<u>In</u>										<u>Pct</u>		
	0-10	Silt loam	CL, ML, CL-ML	A-4, A-6	0	0	0	100	100	96-100	80-97	22-37	2-13
	10-16	Silt loam, silty clay loam, clay loam	CL	A-4, A-6	0	0	0	100	100	96-100	80-98	30-40	8-17
	16-28	Silty clay loam, clay loam	CL	A-6, A-7	0	0	0	100	100	96-100	80-98	33-43	12-20
	28-38	Silty clay loam, clay loam, silty clay	CH, CL	A-6, A-7	0	0	0	100	100	96-100	80-99	33-60	12-35
KrA, KrB: Kirkland-----	38-54	Weathered bedrock			---	---	---	---	---	---	---	---	
	0-10	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	0	100	100	96-100	80-97	22-37	2-13
	10-34	Silty clay, clay	CH, CL	A-7	0	0	0	100	100	96-100	90-99	41-65	18-38
	34-64	Clay, silty clay, clay loam	CH, CL	A-6, A-7	0	0	0	100	100	96-100	76-99	41-70	26-45
	64-80	Weathered bedrock			---	---	---	---	---	---	---	---	
KsB: Kirkland-----	0-10	Silt loam	CL-ML, CL, ML	A-4, A-6	0	0	0	100	100	96-100	80-97	22-37	2-13
	10-34	Silty clay, clay	CH, CL	A-7	0	0	0	100	100	96-100	90-99	41-65	18-38
	34-64	Clay, silty clay, clay loam	CH, CL	A-6, A-7	0	0	0	100	100	96-100	76-99	41-70	26-45
	64-80	Weathered bedrock			---	---	---	---	---	---	---	---	
	0-8	Silt loam	CL-ML, ML	A-4	0	0	0	100	100	96-100	80-97	22-30	2-7
Pawhuska-----	8-46	Silty clay loam, silty clay, clay	CH, CL	A-7	0	0	0	90-100	90-100	85-100	85-99	41-70	20-40
	46-62	Silty clay loam, silty clay, clay	CH, CL	A-7	0	0	0	90-100	90-100	85-100	85-99	41-70	20-40

Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	<u>In</u>				<u>Pct</u>	<u>Pct</u>					<u>Pct</u>	
KwD: Konawa-----	0-6	Loamy fine sand	SM	A-2	0	0	100	98-100	90-100	15-35	0-14	NP
	6-16	Fine sandy loam, loamy fine sand, fine sand	CL-ML, SM, ML, SC-SM	A-3, A-2, A-4	0	0	100	98-100	82-100	5-60	0-26	NP-7
	16-36	Sandy clay loam, fine sandy loam	CL, ML, SM, SC	A-4, A-6	0	0	100	98-100	90-100	36-65	14-37	NP-16
	36-70	Fine sandy loam, sandy clay loam, loamy fine sand	ML, SC-SM, CL-ML, SM	A-2, A-6, A-4	0	0	100	98-100	90-100	15-65	0-37	NP-16
Mc: McLain-----	0-14	Silty clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-99	33-43	13-19
	14-44	Silty clay loam, clay loam, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	44-64	Silt loam, loam, silty clay loam	CH, CL	A-4, A-6, A-7	0	0	100	95-100	95-100	65-99	27-60	7-34
MnD, MnF: Minco-----	0-12	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	94-100	51-75	14-28	NP-7
	12-50	Loam, silt loam, very fine sandy loam	CL, ML, CL-ML	A-4	0	0	100	100	94-100	51-97	14-31	NP-10
	50-72	Loam, silt loam, fine sandy loam	ML, CL, SC, SM	A-4	0	0	100	98-100	94-100	36-97	14-31	NP-10
MsB, MsC: Minco-----	0-12	Silt loam	CL, CL-ML, ML	A-4	0	0	100	100	96-100	65-97	22-31	2-10
	12-50	Loam, silt loam, very fine sandy loam	CL, ML, CL-ML	A-4	0	0	100	100	94-100	51-97	14-31	NP-10
	50-72	Loam, silt loam, fine sandy loam	CL, ML, SM, SC	A-4	0	0	100	98-100	94-100	36-97	14-31	NP-10

Soil Survey of Canadian County, Oklahoma

Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
M-W. Miscellaneous water												
NaD: Nash-----	0-11	Loam	CL, CL-ML, ML A-4		0	0	100	100	96-100	65-97	22-31	2-10
	11-25	Silt loam, loam, very fine sandy loam	CL, CL-ML, ML A-4		0	0	100	100	94-100	51-97	0-31	NP-10
	25-33	Silt loam, loam, very fine sandy loam	CL, CL-ML, ML A-4		0	0	100	100	94-100	51-97	0-31	NP-10
	33-40	Weathered bedrock			---	---	---	---	---	---	---	---
Ironmound-----	0-7	Fine sandy loam	CL-ML, SM, ML, SC-SM	A-2, A-4	0	0	85-100	85-100	80-100	30-60	14-26	NP-7
	7-12	Loam, fine sandy loam, clay loam	CL, CL-ML, ML A-4, A-6		0	0	85-100	80-100	76-100	52-85	14-35	2-18
	12-60	Weathered bedrock			---	---	---	---	---	---	---	---
NaD2: Nash-----	0-8	Loam	CL, CL-ML, ML A-4		0	0	100	100	96-100	65-97	22-31	2-10
	8-25	Silt loam, loam, very fine sandy loam	CL, ML, CL-ML A-4		0	0	100	100	94-100	51-97	0-31	NP-10
	25-30	Silt loam, loam, very fine sandy loam	CL, ML, CL-ML A-4		0	0	100	100	94-100	51-97	0-31	NP-10
	30-40	Weathered bedrock			---	---	---	---	---	---	---	---
Ironmound-----	0-7	Fine sandy loam	ML, CL-ML, SC-SM, SM	A-2, A-4	0	0	85-100	85-100	80-100	30-60	14-26	NP-7
	7-12	Loam, fine sandy loam, clay loam	CL-ML, CL, ML A-4, A-6		0	0	85-100	80-100	76-100	52-85	14-35	2-18
	12-60	Weathered bedrock			---	---	---	---	---	---	---	---

Soil Survey of Canadian County, Oklahoma

Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--					Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200			
											Pct		
NaD3: Nash-----	In											Pct	
	0-8	Loam	CL, CL-ML, ML	A-4	0	0	0	100	100	96-100	65-97	22-31	2-10
	8-22	Silt loam, loam, very fine sandy loam	CL, ML, CL-ML	A-4	0	0	0	100	100	94-100	51-97	0-31	NP-10
	22-30	Silt loam, loam, very fine sandy loam	CL-ML, CL, ML	A-4	0	0	0	100	100	94-100	51-97	0-31	NP-10
	30-40	Weathered bedrock			---	---	---	---	---	---	---	---	---
Ironmound-----	0-7	Fine sandy loam	ML, SC-SM, CL-ML, SM	A-2, A-4	0	0	0	85-100	85-100	80-100	30-60	14-26	NP-7
	7-12	Loam, fine sandy loam	CL, CL-ML, ML	A-4, A-6	0	0	0	85-100	80-100	76-100	52-85	14-35	NP-14
	12-60	Weathered bedrock			---	---	---	---	---	---	---	---	---
NbC: Noble-----	0-10	Fine sandy loam	CL-ML, SM, ML, SC-SM	A-4	0	0	0	100	98-100	94-100	36-60	15-26	NP-7
	10-62	Loam, very fine sandy loam, fine sandy loam	ML, CL-ML, SC-SM, SM	A-4	0	0	0	100	98-100	94-100	36-85	14-29	NP-7
NrB, NrC, NrD: Norge-----	0-10	Silt loam	CL-ML, CL, ML	A-4, A-6	0	0	0	100	100	96-100	65-97	22-35	2-14
	10-15	Silty clay loam, clay loam, silt loam	CL-ML, CL, ML	A-4, A-7, A-6	0	0	0	100	100	96-100	65-98	22-43	2-20
	15-48	Silty clay loam, clay loam	CL	A-6, A-7	0	0	0	100	100	96-100	80-98	33-43	12-20
	48-70	Silty clay loam, clay loam, silty clay	CL	A-6, A-7	0	0	0	100	100	96-100	80-98	33-49	12-22

Soil Survey of Canadian County, Oklahoma

Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
PIT. Pits	In										Pct	
PkA, PkB: Pond Creek-----	0-14	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	96-100	65-97	22-37	3-14
	14-60	Silty clay loam, clay loam, silt loam	CL	A-4, A-7, A-6	0	0	100	100	96-100	75-98	30-43	8-20
Po: Port-----	60-66	Silty clay loam, clay loam, silt loam	CL	A-4, A-7, A-6	0	0	100	100	96-100	65-98	30-43	8-20
Pw: Port-----	0-30	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	27-37	8-14
	30-50	Silty clay loam, clay loam, loam	CL	A-4, A-7, A-6	0	0	100	100	96-100	65-98	27-43	8-20
	50-70	Silty clay loam, clay loam, loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20
QdE: Ironmound-----	0-20	Silty clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	20-50	Silty clay loam, clay loam, loam	CL	A-4, A-6, A-7	0	0	100	100	96-100	65-98	27-43	8-20
	50-70	Silty clay loam, clay loam, loam	CL	A-4, A-7, A-6	0	0	100	100	96-100	65-98	27-43	8-20
QdE: Ironmound-----	0-7	Loam	CL, CL-ML	A-4, A-6	0	0	85-100	85-100	76-100	52-97	24-35	4-13
	7-12	Loam, fine sandy loam, clay loam	CL, CL-ML, ML	A-4, A-6	0	0	85-100	80-100	76-100	52-85	14-35	2-18
	12-60	Weathered bedrock			---	---	---	---	---	---	---	---

Soil Survey of Canadian County, Oklahoma

Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	<u>In</u>				<u>Pct</u>	<u>Pct</u>					<u>Pct</u>	
QdE: Dill-----	0-12	Fine sandy loam	CL-ML, SM, ML, SC-SM	A-2, A-4	0	0	100	100	90-100	20-70	0-26	NP-7
	12-34	Fine sandy loam, very fine sandy loam, loam	ML, CL-ML, SC-SM, SM	A-2, A-4	0	0	98-100	95-100	90-100	20-70	0-26	NP-6
	34-42	Weathered bedrock			---	---	---	---	---	---	---	---
QrF: Ironmound-----	0-7	Loam	CL, CL-ML	A-4, A-6	0	0	85-100	85-100	76-100	52-97	24-35	4-13
	7-12	Loam, fine sandy loam, clay loam	CL, CL-ML, ML	A-4, A-6	0	0	85-100	80-100	76-100	52-85	14-35	2-18
	12-40	Weathered bedrock			---	---	---	---	---	---	---	---
Rock outcrop.												
Ra: Reinach-----	0-30	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	94-100	51-75	14-28	NP-7
	30-60	Loam, very fine sandy loam, silt loam	CL, CL-ML, ML	A-4	0	0	100	100	94-100	51-97	14-31	NP-10
RbA, RbB: Renfrow-----	0-11	Silt loam	CL	A-4, A-6	0	0	100	100	96-100	65-97	30-37	8-14
	11-18	Silty clay loam, clay loam, silt loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	30-50	15-26
	18-65	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
RcC2: Renfrow-----	0-8	Clay loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	33-43	12-20
	8-15	Silty clay loam, clay loam, silt loam	CL	A-6, A-7	0	0	100	100	96-100	80-98	30-50	15-26
	15-65	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34

Soil Survey of Canadian County, Oklahoma

Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--					Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200			
											Pct		
ShB, ShC, ShD: Lovedale-----	In											Pct	
	0-12	Fine sandy loam	CL-ML, SM, ML, SC-SM	A-2, A-4	0	0	0	95-100	95-100	85-100	34-60	14-26	NP-7
	12-19	Sandy clay loam, sandy loam, fine sandy loam	CL, SC	A-2, A-4, A-6	0	0	0	95-100	85-100	80-100	30-65	25-37	7-16
	19-36	Sandy clay loam, sandy loam, fine sandy loam	ML, SC, CL, SM	A-4, A-2, A-6	0	0	0	95-100	85-100	80-100	30-65	14-37	NP-16
	36-62	Coarse sandy loam, fine sandy loam, sand	SC-SM, SM, SP-SM	A-2, A-4	0	0	0	80-100	70-100	60-75	11-45	0-26	NP-7
ShD2: Lovedale-----	0-10	Fine sandy loam	ML, SC-SM, CL-ML, SM	A-2, A-4	0	0	0	95-100	95-100	85-100	34-60	14-26	NP-7
	10-19	Sandy clay loam, sandy loam, fine sandy loam	CL, SC	A-2, A-4, A-6	0	0	0	95-100	85-100	80-100	30-65	25-37	7-16
	19-36	Sandy clay loam, sandy loam, fine sandy loam	CL, ML, SM, SC	A-2, A-4, A-6	0	0	0	95-100	85-100	80-100	30-65	14-37	NP-16
	36-62	Coarse sandy loam, fine sandy loam, sand	SC-SM, SP-SM, SM	A-2, A-4	0	0	0	80-100	70-100	60-75	11-45	0-26	NP-7
SnE: Lovedale-----	0-10	Fine sandy loam	ML, SC-SM, CL-ML, SM	A-2, A-4	0	0	0	95-100	95-100	85-100	34-60	14-26	NP-7
	10-19	Sandy clay loam, sandy loam, fine sandy loam	CL, SC	A-2, A-6, A-4	0	0	0	95-100	85-100	80-100	30-65	25-37	7-16
	19-36	Sandy clay loam, sandy loam, fine sandy loam	CL, SM, ML, SC	A-2, A-4, A-6	0	0	0	95-100	85-100	80-100	30-65	14-37	NP-16
	36-62	Coarse sandy loam, fine sandy loam, sand	SC-SM, SM, SP-SM	A-2, A-4	0	0	0	80-100	70-100	60-75	11-45	0-26	NP-7

Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
SnE: Wisby-----	0-10	Fine sandy loam	ML, SC-SM, CL-ML, SM	A-2, A-4	0	0	85-100	75-100	70-100	27-60	14-26	NP-7
	10-37	Sandy loam, loam	ML, CL-ML, SC-SM, SM	A-2, A-4	0	0	85-100	75-100	71-100	27-60	0-29	NP-7
	37-72	Loamy sand, gravelly sand, sand	SM, SP-SM	A-2, A-1, A-3	0	0	85-100	40-100	37-100	7-35	0-14	NP
Tv: Goodnight-----	0-10	Fine sand	SM, SP-SM	A-2, A-3	0	0	100	98-100	82-98	5-25	0-0	NP
	10-40	Loamy fine sand, fine sand	SM, SP-SM	A-2, A-3	0	0	100	98-100	82-100	5-35	0-14	NP
	40-64	Loamy fine sand, fine sand	SM, SP-SM	A-2, A-3	0	0	100	98-100	82-100	5-35	0-14	NP
VeC: Grainola-----	0-6	Clay loam	CL	A-6, A-7	0-25	0-25	80-100	75-100	72-100	60-98	33-43	12-20
	6-24	Silty clay, clay loam, clay	CH, SC, CL	A-6, A-7	0-25	0-25	80-100	75-100	72-100	49-98	37-60	15-34
	24-32	Clay loam, clay, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
VrE: Grainola-----	32-60	Weathered bedrock			---	---	---	---	---	---	---	---
	0-6	Clay loam	CL	A-6, A-7	0-25	0-25	80-100	75-100	72-100	60-98	33-43	12-20
	6-12	Silty clay, clay loam, clay	CL, CH, SC	A-6, A-7	0-25	0-25	80-100	75-100	72-100	49-98	37-60	15-34
Rock outcrop.	12-32	Clay loam, clay, silty clay	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	32-60	Weathered bedrock			---	---	---	---	---	---	---	---

Engineering Index Properties—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	<u>In</u>				<u>Pct</u>	<u>Pct</u>					<u>Pct</u>	
VsC2: Grainola-----	0-4	Clay loam	CL	A-6, A-7	0-25	0-25	80-100	75-100	72-100	60-98	33-43	12-20
	4-20	Silty clay, clay loam, clay	CH, CL, SC	A-6, A-7	0-25	0-25	80-100	75-100	72-100	49-98	37-60	15-34
	20-28	Clay loam, clay, silty	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
	28-60	Weathered bedrock			---	---	---	---	---	---	---	---
W. Water												
Wa: Watonga-----	0-8	Silty clay	CH, CL	A-7	0	0	100	100	96-100	90-99	41-70	26-45
	8-22	Silty clay, clay, silty	CH, CL	A-7	0	0	100	100	96-100	90-99	41-71	26-45
	22-50	Silty clay, clay, silty	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-70	26-45
	50-72	Silty clay, clay, silty	CH, CL	A-6, A-7	0	0	100	100	96-100	80-99	37-60	15-34
Ya: Yahola-----												
Ya: Yahola-----	0-18	Fine sandy loam	CL-ML, ML, SM, SC-SM	A-4	0	0	100	98-100	94-100	36-60	14-26	NP-7
	18-40	Fine sandy loam, loam, very fine	CL-ML, ML, SM, SC-SM	A-4	0	0	100	98-100	94-100	36-85	14-29	NP-10
	40-60	Sandy loam Stratified loam to loamy fine sand	ML, CL-ML, SC-SM, SM	A-2, A-4	0	0	100	98-100	90-100	15-97	0-30	NP-10

Physical Properties

The table "Physical Properties of the Soils" shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions in this survey.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. The estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $\frac{1}{3}$ -bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In the table "Physical Properties of the Soils," the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at $\frac{1}{3}$ - or $\frac{1}{10}$ -bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. Volume change is influenced by the amount and type of clay minerals in the soil.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to

buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In the table "Physical Properties of Soils," the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Erosion factors.—Soil erodibility (K) and soil-loss tolerance (T) factors are used in an equation that predicts the amount of soil lost through water erosion in areas of cropland. The procedure for predicting soil loss is useful in guiding the selection of soil and water conservation practices.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The soil properties that influence erodibility are those that affect the infiltration rate, the movement of water through the soil, and the water storage capacity of the soil and those that allow the soil to resist dispersion, splashing, abrasion, and the transporting forces of rainfall and runoff. The most important soil properties are the content of silt plus very fine sand, the content of sand coarser than very fine sand, the content of organic matter, soil structure, and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.64. The higher the value, the more susceptible the soil is to sheet and rill erosion.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum annual rate of soil erosion by wind or water that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons of soil loss per acre per year. Ratings of 1 to 5 are used, depending on soil properties and prior erosion. The criteria used in assigning a T factor to a soil include maintenance of an adequate rooting depth for crop production, potential reduction of crop yields, maintenance of water-control structures affected by sedimentation, prevention of gulying, and the value of nutrients lost through erosion.

Wind erodibility groups.—Wind erodibility is directly related to the percentage of dry, nonerodible surface soil aggregates larger than 0.84 millimeter in diameter. From this percentage, the wind erodibility index factor (I) is determined. This factor is an expression of the stability of the soil aggregates, or the extent to which they are broken down by tillage and the abrasion caused by windblown soil particles. Soils are assigned to wind erodibility groups (WEG) having similar percentages of dry soil aggregates larger than 0.84 millimeter.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

WEG 1. Very fine sand, fine sand, sand, and coarse sand.

WEG 2. Loamy very fine sand, loamy fine sand, loamy sand, loamy coarse sand, ash, and sapric organic soil material.

WEG 3. Very fine sandy loam, fine sandy loam, sandy loam, and coarse sandy loam.

WEG 4. Clay, silty clay, and noncalcareous clay loam and silty clay loam with more than 35 percent clay.

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WEG 4L. Calcareous loam, silt loam, clay loam, and silty clay loam characterized by a strongly or violently effervescent reaction to cold dilute (1N) HCl.

WEG 5. Noncalcareous loam and silt loam with less than 20 percent clay and sandy clay loam, sandy clay, and hemic organic soil material.

WEG 6. Noncalcareous loam and silt loam with more than 20 percent clay and noncalcareous clay loam with less than 35 percent clay.

WEG 7. Silt, noncalcareous silty clay loam with less than 35 percent clay, and fibric organic soil material.

WEG 8. Soils that are not susceptible to soil blowing because of rock fragments on the surface or because of surface wetness.

Wind erodibility index is a numerical value indicating the susceptibility to soil blowing, or the tons per acre per year that can be expected to be lost to soil blowing. There is a close correlation between soil blowing and the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence soil blowing.

Additional information about wind erodibility groups and the Kw, Kf, and T factors can be obtained at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Physical Properties of the Soils

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								Kw	Kf	T		
BeA:												
Bethany-----	0-14	15-26	1.30-1.50	0.60-2.00	0.16-0.24	0.0-2.9	1.0-3.0	.43	.43	5	5	56
	14-18	27-35	1.45-1.70	0.20-0.60	0.16-0.22	3.0-5.9	1.0-3.0	.37	.37			
	18-60	35-50	1.40-1.70	0.06-0.20	0.12-0.22	6.0-8.9	0.5-2.0	.37	.37			
	60-80	35-50	1.40-1.70	0.06-0.20	0.12-0.22	6.0-8.9	0.0-2.0	.37	.37			
BnC:												
Binger-----	0-10	10-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	0.5-1.0	.24	.24	3	3	86
	10-32	18-25	1.45-1.65	0.60-2.00	0.12-0.17	0.0-2.9	0.5-1.0	.32	.32			
	32-40	---	1.85-2.00	0.20-0.60	---	---	---	---	---			
Br:												
Brewer-----	0-12	27-32	1.30-1.60	0.20-0.60	0.18-0.22	3.0-5.9	1.0-3.0	.37	.37	5	7	38
	12-64	35-55	1.40-1.70	0.06-0.20	0.12-0.22	6.0-8.9	1.0-3.0	.37	.37			
	64-84	25-40	1.40-1.70	0.06-0.60	0.12-0.22	3.0-5.9	0.5-1.0	.43	.43			
Bu:												
Brewer-----	0-10	18-26	1.30-1.50	0.20-0.60	0.15-0.24	3.0-5.9	1.0-3.0	.43	.43	5	6	48
	10-64	35-55	1.40-1.70	0.06-0.20	0.12-0.22	6.0-8.9	1.0-3.0	.37	.37			
	64-84	25-40	1.40-1.70	0.06-0.60	0.12-0.22	3.0-5.9	0.5-1.0	.43	.43			
Drummond-----	0-10	20-30	1.35-1.55	0.60-2.00	0.08-0.12	0.0-2.9	0.5-1.0	.49	.49	2	6	48
	10-30	35-60	1.40-1.65	0.00-0.06	0.06-0.12	6.0-8.9	0.5-1.0	.37	.37			
	30-42	35-60	1.40-1.65	0.00-0.06	0.06-0.12	6.0-8.9	0.5-1.0	.37	.37			
	42-62	10-18	1.40-1.70	2.00-6.00	0.13-0.19	0.0-2.9	0.0-0.5	.20	.20			
Ca:												
Canadian-----	0-15	5-18	1.40-1.65	2.00-6.00	0.10-0.15	0.0-2.9	1.0-3.0	.20	.20	5	3	86
	15-26	10-18	1.35-1.70	2.00-6.00	0.10-0.20	0.0-2.9	0.0-2.0	.20	.20			
	26-60	5-18	1.40-1.70	2.00-20.00	0.07-0.20	0.0-2.9	0.0-1.0	.20	.20			
Da:												
Dale-----	0-24	15-26	1.30-1.50	0.60-2.00	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	24-42	18-35	1.40-1.70	0.60-2.00	0.15-0.24	3.0-5.9	1.0-2.0	.37	.37			
	42-64	18-35	1.40-1.70	0.60-2.00	0.15-0.24	3.0-5.9	0.5-2.0	.37	.37			
DAM. Large dam												

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Physical Properties of the Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
DnD, DnF: Darnell-----	0-5	10-20	1.30-1.65	2.00-6.00	0.11-0.15	0.0-2.9	0.5-1.0	.20	.24	2	3	86
	5-11	10-25	1.40-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.32	.24			
	11-15	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
Noble-----	0-10	10-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	0.5-1.0	.20	.20	5	3	86
	10-72	10-18	1.30-1.65	2.00-6.00	0.11-0.20	0.0-2.9	0.5-1.0	.32	.32			
DuD: Dill-----	0-12	8-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	0.5-1.0	.20	.20	3	3	86
	12-34	8-18	1.40-1.70	2.00-6.00	0.11-0.15	0.0-2.9	0.0-0.5	.20	.20			
	34-42	---	1.85-2.00	0.20-0.60	---	---	---	---	---			
Ironmound-----	0-7	10-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	1.0-3.0	.20	.20	2	3	86
	7-12	10-27	1.40-1.70	0.60-2.00	0.11-0.20	0.0-2.9	0.0-0.5	.32	.32			
	12-60	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
DUM. Dumps												
Ga: Gracemore-----	0-12	2-10	1.35-1.50	6.00-20.00	0.07-0.11	0.0-2.9	0.5-1.0	.17	.17	5	2	134
	12-72	2-10	1.50-1.70	2.00-20.00	0.02-0.11	0.0-2.9	0.0-0.5	.17	.17			
Gb: Gracemore-----	0-10	2-10	1.35-1.50	6.00-20.00	0.07-0.11	0.0-2.9	0.5-1.0	.17	.17	5	2	134
	10-72	2-10	1.50-1.70	2.00-20.00	0.02-0.11	0.0-2.9	0.0-0.5	.17	.17			
GdB, GdC: Konawa-----	0-7	8-18	1.40-1.65	2.00-6.00	0.13-0.19	0.0-2.9	0.5-1.0	.24	.24	5	3	86
	7-38	18-30	1.45-1.70	0.60-6.00	0.13-0.19	0.0-2.9	0.1-0.7	.24	.24			
	38-60	7-30	1.40-1.70	2.00-6.00	0.07-0.19	0.0-2.9	0.1-0.7	.20	.20			
GdC2: Konawa-----	0-5	8-18	1.40-1.65	2.00-6.00	0.13-0.19	0.0-2.9	0.5-1.0	.24	.24	5	3	86
	5-36	18-30	1.45-1.70	0.60-6.00	0.13-0.19	0.0-2.9	0.1-0.7	.24	.24			
	36-60	7-30	1.40-1.70	2.00-6.00	0.07-0.19	0.0-2.9	0.1-0.7	.20	.20			
GdD: Konawa-----	0-7	8-18	1.40-1.65	2.00-6.00	0.13-0.19	0.0-2.9	0.5-1.0	.24	.24	5	3	86
	7-38	18-30	1.45-1.70	0.60-6.00	0.13-0.19	0.0-2.9	0.1-0.7	.24	.24			
	38-60	7-30	1.40-1.70	2.00-6.00	0.07-0.19	0.0-2.9	0.1-0.7	.20	.20			
GdD3: Konawa-----	0-4	8-18	1.40-1.65	2.00-6.00	0.13-0.19	0.0-2.9	0.5-1.0	.24	.24	4	3	86
	4-35	18-30	1.45-1.70	0.60-6.00	0.13-0.19	0.0-2.9	0.1-0.7	.24	.24			
	35-60	7-30	1.40-1.70	2.00-6.00	0.07-0.19	0.0-2.9	0.1-0.7	.20	.20			

Physical Properties of the Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
GhB: Grant-----	0-10	15-26	1.30-1.50	0.60-2.00	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	4	5	56
	10-18	15-26	1.30-1.55	0.60-2.00	0.13-0.20	0.0-2.9	1.0-3.0	.37	.37			
	18-46	18-35	1.40-1.70	0.60-2.00	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	46-60	15-26	1.40-1.65	0.60-2.00	0.16-0.22	0.0-2.9	0.5-1.0	.37	.37			
	60-64	---	1.85-2.00	0.00-0.06	---	---	---	---	---			
Pawhuska-----	0-8	18-27	1.30-1.50	0.60-2.00	0.12-0.18	0.0-2.9	0.5-3.0	.49	.49	2	6	48
	8-32	35-50	1.35-1.65	0.00-0.06	0.06-0.20	6.0-8.9	0.5-2.0	.43	.43			
	32-62	35-50	1.35-1.65	0.00-0.06	0.06-0.20	6.0-8.9	0.5-2.0	.43	.43			
GpE: Grant-----	0-10	15-26	1.30-1.50	0.60-2.00	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	4	5	56
	10-18	15-26	1.30-1.55	0.60-2.00	0.13-0.20	0.0-2.9	1.0-3.0	.37	.37			
	18-46	18-35	1.40-1.70	0.60-2.00	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	46-60	15-26	1.40-1.65	0.60-2.00	0.16-0.22	0.0-2.9	0.5-1.0	.37	.37			
	60-64	---	1.85-2.00	0.00-0.06	---	---	---	---	---			
Port-----	0-30	12-26	1.30-1.55	0.60-2.00	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	30-50	20-35	1.30-1.60	0.60-2.00	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	50-70	20-35	1.30-1.60	0.60-2.00	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
GuD: Grant-----	0-10	15-26	1.30-1.50	0.60-2.00	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	4	5	56
	10-18	15-26	1.30-1.55	0.60-2.00	0.13-0.20	0.0-2.9	1.0-3.0	.37	.37			
	18-46	18-35	1.40-1.70	0.60-2.00	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	46-60	15-26	1.40-1.65	0.60-2.00	0.16-0.22	0.0-2.9	0.5-1.0	.37	.37			
	60-64	---	1.85-2.00	0.00-0.06	---	---	---	---	---			
Ironmound-----	0-7	15-25	1.30-1.55	0.60-2.00	0.15-0.20	0.0-2.9	1.0-3.0	.32	.32	2	5	56
	7-12	10-27	1.40-1.70	0.60-2.00	0.11-0.20	0.0-2.9	0.0-0.5	.32	.32			
	12-60	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
GuD2: Grant-----	0-8	15-26	1.30-1.50	0.60-2.00	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	4	5	56
	8-16	15-26	1.30-1.55	0.60-2.00	0.13-0.20	0.0-2.9	1.0-3.0	.37	.37			
	16-44	18-35	1.40-1.70	0.60-2.00	0.15-0.20	0.0-2.9	0.5-1.0	.37	.37			
	44-58	15-26	1.40-1.65	0.60-2.00	0.16-0.22	0.0-2.9	0.5-1.0	.37	.37			
	58-62	---	1.85-2.00	0.00-0.06	---	---	---	---	---			
Ironmound-----	0-7	15-25	1.30-1.55	0.60-2.00	0.15-0.20	0.0-2.9	1.0-3.0	.32	.32	2	5	56
	7-12	10-27	1.40-1.70	0.60-2.00	0.11-0.20	0.0-2.9	0.0-0.5	.32	.32			
	12-60	---	1.85-2.00	0.00-0.20	---	---	---	---	---			

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Physical Properties of the Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
KfB, KfC: Kingfisher-----	0-10	15-27	1.30-1.55	0.60-2.00	0.16-0.24	0.0-2.9	1.0-3.0	.37	.37	3	5	56
	10-16	25-35	1.40-1.70	0.20-0.60	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	16-28	27-35	1.45-1.70	0.20-0.60	0.15-0.22	3.0-5.9	0.0-0.5	.32	.32			
	28-38	27-40	1.45-1.70	0.20-0.60	0.14-0.22	3.0-5.9	0.0-0.5	.32	.32			
	38-54	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
KrA, KrB: Kirkland-----	0-10	13-26	1.30-1.50	0.60-2.00	0.16-0.24	0.0-2.9	1.0-3.0	.49	.49	5	5	56
	10-34	40-60	1.35-1.60	0.00-0.06	0.10-0.14	6.0-8.9	1.0-2.0	.37	.37			
	34-64	35-60	1.30-1.65	0.00-0.06	0.10-0.18	9.0-25.0	0.5-1.0	.32	.32			
	64-80	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
KSB: Kirkland-----	0-10	13-26	1.30-1.50	0.60-2.00	0.16-0.24	0.0-2.9	1.0-3.0	.49	.49	5	5	56
	10-34	40-60	1.35-1.60	0.00-0.06	0.10-0.14	6.0-8.9	1.0-2.0	.37	.37			
	34-64	35-60	1.30-1.65	0.00-0.06	0.10-0.18	9.0-25.0	0.5-1.0	.32	.32			
	64-80	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
Pawhuska-----	0-8	18-27	1.30-1.50	0.60-2.00	0.12-0.18	0.0-2.9	0.5-3.0	.49	.49	2	6	48
	8-46	35-50	1.35-1.65	0.00-0.06	0.06-0.20	6.0-8.9	0.5-2.0	.43	.43			
	46-62	35-50	1.35-1.65	0.00-0.06	0.06-0.20	6.0-8.9	0.5-2.0	.43	.43			
KwD: Konawa-----	0-6	2-10	1.45-1.65	2.00-6.00	0.07-0.11	0.0-2.9	0.5-1.0	.20	.20	5	2	134
	6-16	2-15	1.40-1.75	0.60-2.00	0.05-0.19	0.0-2.9	0.3-1.0	.32	.32			
	16-36	18-30	1.45-1.70	0.60-6.00	0.13-0.19	0.0-2.9	0.1-0.7	.24	.24			
	36-70	7-30	1.40-1.70	2.00-6.00	0.07-0.19	0.0-2.9	0.1-0.7	.20	.20			
Mc: McLain-----	0-14	27-35	1.30-1.60	0.20-0.60	0.15-0.22	3.0-5.9	1.0-3.0	.37	.37	5	7	38
	14-44	35-50	1.45-1.70	0.06-0.20	0.12-0.22	6.0-8.9	0.5-2.0	.37	.37			
	44-64	20-45	1.40-1.70	0.06-0.60	0.12-0.24	6.0-8.9	0.5-2.0	.43	.43			
MnD, MnF: Minco-----	0-12	8-18	1.35-1.60	0.60-2.00	0.13-0.24	0.0-2.9	1.0-3.0	.37	.37	5	3	86
	12-50	8-18	1.35-1.60	0.60-2.00	0.13-0.24	0.0-2.9	1.0-3.0	.37	.37			
	50-72	8-18	1.35-1.60	0.60-2.00	0.11-0.24	0.0-2.9	0.5-1.0	.37	.37			
MSB, MSC: Minco-----	0-12	8-18	1.35-1.60	0.60-2.00	0.13-0.24	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	12-50	8-18	1.35-1.60	0.60-2.00	0.13-0.24	0.0-2.9	1.0-3.0	.37	.37			
	50-72	8-18	1.35-1.60	0.60-2.00	0.11-0.24	0.0-2.9	0.5-1.0	.37	.37			
M-W. Miscellaneous water												

Physical Properties of the Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								Kw	Kf	T		
NaD: Nash-----	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
	0-11	10-18	1.30-1.55	0.60-2.00	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	3	5	56
	11-25	10-18	1.40-1.65	0.60-2.00	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	25-33	10-18	1.40-1.65	0.60-2.00	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	33-40	---	1.85-2.00	0.20-0.60	---	---	---	---	---			
Ironmound-----	0-7	10-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	1.0-3.0	.20	.20	2	3	86
	7-12	10-27	1.40-1.70	0.60-2.00	0.11-0.20	0.0-2.9	0.0-0.5	.32	.32			
	12-60	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
NaD2: Nash-----	0-8	10-18	1.30-1.55	0.60-2.00	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	3	5	56
	8-25	10-18	1.40-1.65	0.60-2.00	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	25-30	10-18	1.40-1.65	0.60-2.00	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	30-40	---	1.85-2.00	0.20-0.60	---	---	---	---	---			
	0-7	10-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	1.0-3.0	.20	.20	2	3	86
Ironmound-----	7-12	10-27	1.40-1.70	0.60-2.00	0.11-0.20	0.0-2.9	0.0-0.5	.32	.32			
	12-60	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
	0-8	10-18	1.30-1.55	0.60-2.00	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	2	5	56
	8-22	10-18	1.40-1.65	0.60-2.00	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	22-30	10-18	1.40-1.65	0.60-2.00	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
Ironmound-----	30-40	---	1.85-2.00	0.20-0.60	---	---	---	---	---			
	0-7	10-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	1.0-3.0	.20	.20	1	3	86
	7-12	10-27	1.40-1.70	0.60-2.00	0.11-0.20	0.0-2.9	0.0-0.5	.32	.32			
	12-60	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
	0-8	10-18	1.30-1.55	0.60-2.00	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	2	5	56
NaD3: Nash-----	8-22	10-18	1.40-1.65	0.60-2.00	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	22-30	10-18	1.40-1.65	0.60-2.00	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	30-40	---	1.85-2.00	0.20-0.60	---	---	---	---	---			
	0-7	10-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	1.0-3.0	.20	.20	1	3	86
	7-12	10-27	1.40-1.70	0.60-2.00	0.11-0.20	0.0-2.9	0.0-0.5	.32	.32			
Ironmound-----	12-60	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
	0-8	10-18	1.30-1.55	0.60-2.00	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	2	5	56
	8-22	10-18	1.40-1.65	0.60-2.00	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	22-30	10-18	1.40-1.65	0.60-2.00	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
	30-40	---	1.85-2.00	0.20-0.60	---	---	---	---	---			
NbC: Noble-----	0-7	10-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	1.0-3.0	.20	.20	1	3	86
	7-12	10-27	1.40-1.70	0.60-2.00	0.11-0.20	0.0-2.9	0.0-0.5	.32	.32			
	12-60	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
	0-10	10-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	0.5-1.0	.20	.20	5	3	86
	10-62	10-18	1.30-1.65	2.00-6.00	0.11-0.20	0.0-2.9	0.5-1.0	.32	.32			
NrB, NrC, NrD: Norge-----	0-10	15-26	1.30-1.50	0.60-2.00	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	10-15	18-35	1.40-1.70	0.20-2.00	0.15-0.24	3.0-5.9	0.5-2.0	.32	.32			
	15-48	27-35	1.45-1.70	0.20-0.60	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
	48-70	27-50	1.45-1.70	0.20-0.60	0.15-0.22	3.0-5.9	0.5-1.0	.32	.32			
PIT. Pits												
PkA, PkB: Pond Creek-----	0-14	15-26	1.30-1.50	0.60-2.00	0.15-0.20	0.0-2.9	1.0-3.0	.37	.37	5	6	48
	14-60	20-35	1.30-1.60	0.20-0.60	0.15-0.22	3.0-5.9	1.0-3.0	.32	.32			
	60-66	20-40	1.40-1.70	0.20-0.60	0.15-0.22	3.0-5.9	0.0-1.0	.37	.37			

Soil Survey of Canadian County, Oklahoma

Physical Properties of the Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
Po:												
Port-----	0-30	12-26	1.30-1.55	0.60-2.00	0.15-0.24	0.0-2.9	1.0-3.0	.37	.37	5	5	56
	30-50	20-35	1.30-1.60	0.60-2.00	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	50-70	20-35	1.30-1.60	0.60-2.00	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
Pw:												
Port-----	0-20	27-35	1.30-1.60	0.60-2.00	0.15-0.24	3.0-5.9	1.0-3.0	.32	.32	5	6	48
	20-50	20-35	1.30-1.60	0.60-2.00	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
	50-70	20-35	1.30-1.60	0.60-2.00	0.15-0.24	3.0-5.9	0.0-1.0	.37	.37			
QdE:												
Ironmound-----	0-7	15-25	1.30-1.55	0.60-2.00	0.15-0.20	0.0-2.9	1.0-3.0	.32	.32	2	5	56
	7-12	10-27	1.40-1.70	0.60-2.00	0.11-0.20	0.0-2.9	0.0-0.5	.32	.32			
	12-60	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
Dill-----	0-12	8-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	0.5-1.0	.20	.20	3	3	86
	12-34	8-18	1.40-1.70	2.00-6.00	0.11-0.15	0.0-2.9	0.0-0.5	.20	.20			
	34-42	---	1.85-2.00	0.20-0.60	---	---	---	---	---			
QrF:												
Ironmound-----	0-7	15-25	1.30-1.55	0.60-2.00	0.15-0.20	0.0-2.9	1.0-3.0	.32	.32	2	5	56
	7-12	10-27	1.40-1.70	0.60-2.00	0.11-0.20	0.0-2.9	0.0-0.5	.32	.32			
	12-40	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
Rock outcrop.												
Ra:												
Reinach-----	0-30	12-18	1.30-1.55	0.60-2.00	0.13-0.20	0.0-2.9	1.0-3.0	.37	.37	5	3	86
	30-60	12-18	1.30-1.55	0.60-2.00	0.13-0.24	0.0-2.9	0.5-1.0	.37	.37			
RbA, RbB:												
Renfrow-----	0-11	18-26	1.25-1.55	0.60-2.00	0.15-0.24	0.0-2.9	1.0-3.0	.49	.49	5	6	48
	11-18	22-40	1.30-1.75	0.20-0.60	0.15-0.24	3.0-5.9	0.5-2.0	.43	.43			
	18-65	35-55	1.30-1.75	0.00-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
RcC2:												
Renfrow-----	0-8	27-35	1.30-1.55	0.20-0.60	0.15-0.22	3.0-5.9	1.0-3.0	.43	.43	5	6	48
	8-15	22-40	1.30-1.75	0.20-0.60	0.15-0.24	3.0-5.9	0.5-2.0	.43	.43			
	15-65	35-55	1.30-1.75	0.00-0.06	0.12-0.22	6.0-8.9	0.5-1.0	.43	.43			
ShB, ShC, ShD:												
Lovedale-----	0-12	8-16	1.30-1.60	0.60-2.00	0.10-0.15	0.0-2.9	1.0-2.0	.24	.24	5	3	86
	12-19	18-27	1.50-1.70	0.60-2.00	0.12-0.17	0.0-2.9	0.0-1.0	.28	.32			
	19-36	8-27	1.50-1.70	0.60-2.00	0.10-0.17	0.0-2.9	0.0-0.5	.28	.32			
	36-62	3-18	1.50-1.70	2.00-20.00	0.02-0.15	0.0-2.9	0.0-0.5	.15	.20			

Physical Properties of the Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
ShD2:												
Lovedale-----	0-10	8-16	1.30-1.60	0.60-2.00	0.10-0.15	0.0-2.9	1.0-2.0	.24	.24	5	3	86
	10-19	18-27	1.50-1.70	0.60-2.00	0.12-0.17	0.0-2.9	0.0-1.0	.28	.32			
	19-36	8-27	1.50-1.70	0.60-2.00	0.10-0.17	0.0-2.9	0.0-0.5	.28	.32			
	36-62	3-18	1.50-1.70	2.00-20.00	0.02-0.15	0.0-2.9	0.0-0.5	.15	.20			
SnE:												
Lovedale-----	0-10	8-16	1.30-1.60	0.60-2.00	0.10-0.15	0.0-2.9	1.0-2.0	.24	.24	5	3	86
	10-19	18-27	1.50-1.70	0.60-2.00	0.12-0.17	0.0-2.9	0.0-1.0	.28	.32			
	19-36	8-27	1.50-1.70	0.60-2.00	0.10-0.17	0.0-2.9	0.0-0.5	.28	.32			
	36-62	3-18	1.50-1.70	2.00-20.00	0.02-0.15	0.0-2.9	0.0-0.5	.15	.20			
Wisby-----	0-10	7-15	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	1.0-2.0	.15	.20	4	3	86
	10-37	10-18	1.40-1.70	2.00-6.00	0.10-0.20	0.0-2.9	0.5-2.0	.24	.32			
	37-72	2-10	1.50-1.70	6.00-20.00	0.02-0.06	0.0-2.9	0.0-0.5	.10	.10			
Tv:												
Goodnight-----	0-10	2-10	1.35-1.50	6.00-20.00	0.02-0.06	0.0-2.9	0.5-1.0	.15	.15	5	1	220
	10-40	2-12	1.50-1.70	6.00-20.00	0.02-0.11	0.0-2.9	0.5-1.0	.15	.15			
	40-64	2-12	1.50-1.70	6.00-20.00	0.02-0.11	0.0-2.9	0.5-1.0	.15	.15			
VeC:												
Grainola-----	0-6	27-35	1.30-1.55	0.20-0.60	0.15-0.22	3.0-5.9	0.5-1.0	.37	.37	3	7	38
	6-24	35-60	1.30-1.70	0.06-0.20	0.10-0.20	6.0-8.9	0.0-0.5	.37	.37			
	24-32	35-60	1.30-1.70	0.06-0.20	0.12-0.20	6.0-8.9	0.0-0.5	.37	.37			
	32-60	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
VrE:												
Grainola-----	0-6	27-35	1.30-1.55	0.20-0.60	0.15-0.22	3.0-5.9	0.5-1.0	.37	.37	3	7	38
	6-12	35-60	1.30-1.70	0.06-0.20	0.10-0.20	6.0-8.9	0.0-0.5	.37	.37			
	12-32	35-60	1.30-1.70	0.06-0.20	0.12-0.20	6.0-8.9	0.0-0.5	.37	.37			
	32-60	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
Rock outcrop.												
VsC2:												
Grainola-----	0-4	27-35	1.30-1.55	0.20-0.60	0.15-0.22	3.0-5.9	0.5-1.0	.37	.37	3	7	38
	4-20	35-60	1.30-1.70	0.06-0.20	0.10-0.20	6.0-8.9	0.0-0.5	.37	.37			
	20-28	35-60	1.30-1.70	0.06-0.20	0.12-0.20	6.0-8.9	0.0-0.5	.37	.37			
	28-60	---	1.85-2.00	0.00-0.20	---	---	---	---	---			
W.												
Water												

Physical Properties of the Soils—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
Wa: Watonga-----	0-8	40-60	1.25-1.45	0.00-0.06	0.12-0.18	6.0-8.9	1.0-3.0	.37	.37	5	4	86
	8-22	40-60	1.25-1.45	0.00-0.06	0.12-0.22	9.0-25.0	1.0-3.0	.37	.37			
	22-50	35-60	1.35-1.70	0.00-0.06	0.12-0.20	9.0-25.0	0.5-2.0	.37	.37			
	50-72	35-50	1.35-1.70	0.00-0.06	0.12-0.20	6.0-8.9	0.5-1.0	.37	.37			
Ya: Yahola-----	0-18	10-18	1.40-1.65	2.00-6.00	0.13-0.19	0.0-2.9	0.5-1.0	.20	.20	5	3	86
	18-40	5-18	1.30-1.70	2.00-6.00	0.13-0.20	0.0-2.9	0.0-0.5	.32	.32			
	40-60	5-18	1.30-1.70	2.00-6.00	0.07-0.19	0.0-2.9	0.0-0.5	.32	.32			

Chemical Properties

The table "Chemical Properties of the Soils" shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions in this survey.

Cation-exchange capacity is the total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. Soils having a high cation-exchange capacity can retain cations. The ability to retain cations helps to prevent the pollution of ground water.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the soil. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Gypsum is given as the percent, by weight, of hydrated calcium sulfates in the soil. Gypsum is partially soluble in water and can be dissolved and removed by water. Soils that have a high content of gypsum (more than 10 percent) may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter (decisiemens per meter) at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of the soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio is the measure of sodium relative to calcium and magnesium in the water extract from saturated soil paste. Soils having a sodium adsorption ratio of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced permeability and aeration, and a general degradation of soil structure.

Soil Survey of Canadian County, Oklahoma

Chemical Properties of the Soils

(Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbonate equiv- alent	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
BeA:							
Bethany-----	0-14	10-16	5.1-7.8	0	0	0	0
	14-18	17-21	6.1-7.8	0	0	0	0
	18-60	21-30	6.6-8.4	0-2	0	0	0
	60-80	21-30	6.6-8.4	0-10	0	0.0-2.0	0-4
BnC:							
Binger-----	0-10	7.0-11	6.1-7.8	0	0	0	0
	10-32	11-15	6.1-7.8	0	0	0	0
	32-40	---	---	---	---	---	---
Br:							
Brewer-----	0-12	16-19	5.6-7.3	0	0	0	0
	12-64	21-33	6.1-8.4	0-2	0-1	0	0-7
	64-84	15-24	6.6-8.4	0-2	0-1	0.0-8.0	0-7
Bu:							
Brewer-----	0-10	11-16	5.6-7.3	0	0	0	0
	10-64	21-33	6.1-8.4	0-2	0-1	0	0-7
	64-84	15-24	6.6-8.4	0-2	0-1	0.0-8.0	0-7
Drummond-----	0-10	12-18	7.4-8.4	0	0	4.0-16.0	0-13
	10-30	21-35	7.9-9.0	1-3	0	4.0-16.0	13-21
	30-42	21-35	7.9-9.0	1-3	0	4.0-16.0	13-21
	42-62	6.0-11	7.9-9.0	0-5	0	8.0-16.0	13-21
Ca:							
Canadian-----	0-15	3.0-11	5.6-7.8	0	0	0	0
	15-26	6.0-11	6.1-8.4	0	0	0	0
	26-60	3.0-11	6.1-8.4	0	0	0	0
Da:							
Dale-----	0-24	10-16	6.1-7.8	0	0	0	0
	24-42	11-21	6.6-8.4	0-5	0	0	0
	42-64	11-21	6.6-8.4	0-5	0	0	0
DAM.							
Large dam							
DnD, DnF:							
Darnell-----	0-5	7.0-13	5.1-7.3	0	0	0	0
	5-11	7.0-16	5.1-7.3	0	0	0	0
	11-15	---	---	---	---	---	---
Noble-----	0-10	6.0-11	5.6-7.3	0	0	0	0
	10-72	6.0-11	5.6-7.3	0	0	0	0
DuD:							
Dill-----	0-12	5.0-11	6.1-7.8	0	0	0	0
	12-34	5.0-11	6.1-7.8	0	0	0	0
	34-42	---	---	---	---	---	---
Ironmound-----	0-7	7.0-11	5.6-8.4	0	0	0	0
	7-12	10-21	6.1-8.4	0	0	0	0
	12-60	---	---	---	---	---	---

Soil Survey of Canadian County, Oklahoma

Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbonate equiv- alent	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
DUM. Dumps							
Ga:							
Gracemore-----	0-12	2.0-7.0	7.4-8.4	0-1	0	0.0-4.0	0-2
	12-72	2.0-7.0	7.9-8.4	0-1	0	0.0-4.0	0-2
Gb:							
Gracemore-----	0-10	2.0-7.0	7.4-8.4	0-1	0	0.0-4.0	0-2
	10-72	2.0-7.0	7.9-8.4	0-1	0	0.0-4.0	0-2
GdB, GdC:							
Konawa-----	0-7	6.0-11	5.1-6.5	0	0	0	0
	7-38	11-18	5.1-7.3	0	0	0	0
	38-60	5.0-18	5.1-6.5	0	0	0	0
GdC2:							
Konawa-----	0-5	6.0-11	5.1-6.5	0	0	0	0
	5-36	11-18	5.1-7.3	0	0	0	0
	36-60	5.0-18	5.1-6.5	0	0	0	0
GdD:							
Konawa-----	0-7	6.0-11	5.1-6.5	0	0	0	0
	7-38	11-18	5.1-7.3	0	0	0	0
	38-60	5.0-18	5.1-6.5	0	0	0	0
GdD3:							
Konawa-----	0-4	6.0-11	5.1-6.5	0	0	0	0
	4-35	11-18	5.1-7.3	0	0	0	0
	35-60	5.0-18	5.1-6.5	0	0	0	0
GhB:							
Grant-----	0-10	10-16	6.1-7.8	0	0	0	0
	10-18	10-16	6.1-7.8	0	0	0	0
	18-46	11-21	6.1-8.4	0-2	0	0	0
	46-60	10-16	7.4-8.4	0-2	0	0	0
	60-64	---	---	0-5	---	---	---
Pawhuska-----	0-8	11-17	5.6-8.4	0	0	2.0-16.0	5-20
	8-32	21-30	6.1-8.4	0-2	0-2	2.0-16.0	16-25
	32-62	21-30	6.1-8.4	0-2	0-2	2.0-16.0	16-25
GpE:							
Grant-----	0-10	10-16	6.1-7.8	0	0	0	0
	10-18	10-16	6.1-7.8	0	0	0	0
	18-46	11-21	6.1-8.4	0-2	0	0	0
	46-60	10-16	7.4-8.4	0-2	0	0	0
	60-64	---	---	0-5	---	---	---
Port-----	0-30	8.0-16	5.6-7.8	0-2	0	0	0
	30-50	12-21	6.1-8.4	0	0	0	0
	50-70	12-21	6.1-8.4	0	0	0	0
GuD:							
Grant-----	0-10	10-16	6.1-7.8	0	0	0	0
	10-18	10-16	6.1-7.8	0	0	0	0
	18-46	11-21	6.1-8.4	0-2	0	0	0
	46-60	10-16	7.4-8.4	0-2	0	0	0
	60-64	---	---	0-5	---	---	---

Soil Survey of Canadian County, Oklahoma

Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbonate equiv- alent	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
GuD:							
Ironmound-----	0-7	10-15	5.6-8.4	0	0	0	0
	7-12	10-21	6.1-8.4	0	0	0	0
	12-60	---	---	---	---	---	---
GuD2:							
Grant-----	0-8	10-16	6.1-7.8	0	0	0	0
	8-16	10-16	6.1-7.8	0	0	0	0
	16-44	11-21	6.1-8.4	0-2	0	0	0
	44-58	10-16	7.4-8.4	0-2	0	0	0
	58-62	---	---	0-5	---	---	---
Ironmound-----	0-7	10-15	5.6-8.4	0	0	0	0
	7-12	10-21	6.1-8.4	0	0	0	0
	12-60	---	---	---	---	---	---
KfB, KfC:							
Kingfisher-----	0-10	9.0-16	6.1-7.8	0	0	0	0
	10-16	15-21	6.1-7.8	0	0	0	0
	16-28	16-21	6.6-8.4	0	0	0	0
	28-38	16-24	6.6-8.4	0	0	0	0
	38-54	---	---	---	---	---	---
KrA, KrB:							
Kirkland-----	0-10	10-16	5.6-7.3	0	0	0.0-2.0	1-4
	10-34	24-36	6.6-8.4	0-2	0	0.0-2.0	2-12
	34-64	21-36	7.4-8.4	0-2	0-2	2.0-4.0	3-16
	64-80	---	---	---	---	---	---
KsB:							
Kirkland-----	0-10	10-16	5.6-7.3	0	0	0.0-2.0	1-4
	10-34	24-36	6.6-8.4	0-2	0	0.0-2.0	2-12
	34-64	21-36	7.4-8.4	0-2	0-2	2.0-4.0	3-16
	64-80	---	---	---	---	---	---
Pawhuska-----	0-8	11-17	5.6-8.4	0	0	2.0-16.0	5-20
	8-46	21-30	6.1-8.4	0-2	0-2	2.0-16.0	16-25
	46-62	21-30	6.1-8.4	0-2	0-2	2.0-16.0	16-25
KwD:							
Konawa-----	0-6	2.0-7.0	5.1-6.5	0	0	0	0
	6-16	2.0-10	5.1-6.5	0	0	0	0
	16-36	11-18	5.1-7.3	0	0	0	0
	36-70	5.0-18	5.1-6.5	0	0	0	0
Mc:							
McLain-----	0-14	16-21	5.6-8.4	0	0	0	0
	14-44	21-29	6.1-8.4	0	0	0	0
	44-64	12-27	6.6-8.4	0	0	0	0
MnD, MnF, MsB, MsC:							
Minco-----	0-12	5.0-11	5.6-7.3	0	0	0	0
	12-50	5.0-11	5.6-8.4	0	0	0	0
	50-72	5.0-11	6.1-8.4	0	0-2	0	0
M-W.							
Miscellaneous water							

Soil Survey of Canadian County, Oklahoma

Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbonate equiv- alent	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
NaD:							
Nash-----	0-11	6.0-11	6.1-8.4	0	0	0	0
	11-25	6.0-11	6.1-8.4	0	0	0	0
	25-33	6.0-11	6.1-8.4	0	0	0	0
	33-40	---	---	---	---	---	---
Ironmound-----	0-7	7.0-11	5.6-8.4	0	0	0	0
	7-12	10-21	6.1-8.4	0	0	0	0
	12-60	---	---	---	---	---	---
NaD2:							
Nash-----	0-8	6.0-11	6.1-8.4	0	0	0	0
	8-25	6.0-11	6.1-8.4	0	0	0	0
	25-30	6.0-11	6.1-8.4	0	0	0	0
	30-40	---	---	---	---	---	---
Ironmound-----	0-7	7.0-11	5.6-8.4	0	0	0	0
	7-12	10-21	6.1-8.4	0	0	0	0
	12-60	---	---	---	---	---	---
NaD3:							
Nash-----	0-8	6.0-11	6.1-8.4	0	0	0	0
	8-22	6.0-11	6.1-8.4	0	0	0	0
	22-30	6.0-11	6.1-8.4	0	0	0	0
	30-40	---	---	---	---	---	---
Ironmound-----	0-7	7.0-11	5.6-8.4	0	0	0	0
	7-12	10-21	6.1-8.4	0	0	0	0
	12-60	---	---	---	---	---	---
NbC:							
Noble-----	0-10	6.0-11	5.6-7.3	0	0	0	0
	10-62	6.0-11	5.6-7.3	0	0	0	0
NrB, NrC, NrD:							
Norge-----	0-10	10-16	5.6-7.3	0	0	0	0
	10-15	11-21	5.6-7.3	0	0	0	0
	15-48	17-21	5.6-7.8	0	0	0	0
	48-70	17-30	6.1-8.4	0-2	0	0	0
PIT. Pits							
PkA, PkB:							
Pond Creek-----	0-14	9.0-15	5.1-7.3	0	0	0	0
	14-60	9.0-21	6.1-7.8	0	0	0	0
	60-66	12-21	6.1-8.4	0	0	0	0
Po:							
Port-----	0-30	8.0-16	5.6-7.8	0-2	0	0	0
	30-50	12-21	6.1-8.4	0	0	0	0
	50-70	12-21	6.1-8.4	0	0	0	0
Pw:							
Port-----	0-20	17-21	5.6-7.8	0-2	0	0	0
	20-50	12-21	6.1-8.4	0	0	0	0
	50-70	12-21	6.1-8.4	0	0	0	0

Soil Survey of Canadian County, Oklahoma

Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbonate equiv- alent	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
QdE:							
Ironmound-----	0-7	10-15	5.6-8.4	0	0	0	0
	7-12	10-21	6.1-8.4	0	0	0	0
	12-60	---	---	---	---	---	---
Dill-----	0-12	5.0-11	6.1-7.8	0	0	0	0
	12-34	5.0-11	6.1-7.8	0	0	0	0
	34-42	---	---	---	---	---	---
QrF:							
Ironmound-----	0-7	10-15	5.6-8.4	0	0	0	0
	7-12	10-21	6.1-8.4	0	0	0	0
	12-40	---	---	---	---	---	---
Rock outcrop.							
Ra:							
Reinach-----	0-30	8.0-11	6.1-8.4	0-1	0	0	0
	30-60	8.0-11	7.4-8.4	0-2	0	0	0
RbA, RbB:							
Renfrow-----	0-11	11-16	6.1-7.8	0	0	0	0
	11-18	14-24	6.1-7.8	0	0	0	0
	18-65	21-33	6.1-8.4	0	0	0.0-2.0	0-4
RcC2:							
Renfrow-----	0-8	17-21	6.1-7.8	0	0	0	0
	8-15	14-24	6.1-7.8	0	0	0	0
	15-65	21-33	6.1-8.4	0	0	0.0-2.0	0-4
ShB, ShC, ShD:							
Lovedale-----	0-12	6.0-10	5.6-7.3	0	0	0	0
	12-19	11-17	6.1-8.4	0	0	0	0
	19-36	6.0-17	6.1-8.4	0	0	0	0
	36-62	3.0-11	6.1-8.4	0-5	0	0	0
ShD2:							
Lovedale-----	0-10	6.0-10	5.6-7.3	0	0	0	0
	10-19	11-17	6.1-8.4	0	0	0	0
	19-36	6.0-17	6.1-8.4	0	0	0	0
	36-62	3.0-11	6.1-8.4	0-5	0	0	0
SnE:							
Lovedale-----	0-10	6.0-10	5.6-7.3	0	0	0	0
	10-19	11-17	6.1-8.4	0	0	0	0
	19-36	6.0-17	6.1-8.4	0	0	0	0
	36-62	3.0-11	6.1-8.4	0-5	0	0	0
Wisby-----	0-10	5.0-10	5.6-7.3	0	0	0	0
	10-37	7.0-11	6.1-7.3	0	0	0	0
	37-72	2.0-7.0	6.1-8.4	0	0	0	0
Tv:							
Goodnight-----	0-10	2.0-7.0	6.1-8.4	0-2	0	0	0
	10-40	4.0-8.0	6.1-8.4	0-2	0	0	0
	40-64	4.0-8.0	6.1-8.4	0-2	0	0	0

Soil Survey of Canadian County, Oklahoma

Chemical Properties of the Soils—Continued

Map symbol and soil name	Depth	Cation- exchange capacity	Soil reaction	Calcium carbonate equiv- alent	Gypsum	Salinity	Sodium adsorp- tion ratio
	<u>In</u>	<u>meq/100 g</u>	<u>pH</u>	<u>Pct</u>	<u>Pct</u>	<u>mmhos/cm</u>	
VeC:							
Grainola-----	0-6	17-21	6.6-8.4	0-2	0	0	0
	6-24	21-36	7.9-8.4	0-5	0	0	0
	24-32	21-36	7.9-8.4	0-10	0	0	0
	32-60	---	---	0	0	---	0
VrE:							
Grainola-----	0-6	17-21	6.6-8.4	0-2	0	0	0
	6-12	21-36	7.9-8.4	0-5	0	0	0
	12-32	21-36	7.9-8.4	0-10	0	0	0
	32-60	---	---	0	0	---	0
Rock outcrop.							
VsC2:							
Grainola-----	0-4	17-21	6.6-8.4	0-2	0	0	0
	4-20	21-36	7.9-8.4	0-5	0	0	0
	20-28	21-36	7.9-8.4	0-10	0	0	0
	28-60	---	0.0-0.0	0	0	---	0
W. Water							
Wa:							
Watonga-----	0-8	24-35	6.6-8.4	0-2	0	0	0
	8-22	24-35	6.6-8.4	2-5	0	0	0
	22-50	21-35	7.4-8.4	2-10	0	0	0
	50-72	21-35	7.4-8.4	5-15	0	0	0
Ya:							
Yahola-----	0-18	7.0-11	7.4-8.4	0-1	0	0	0
	18-40	4.0-11	7.9-8.4	1-5	0	0	0
	40-60	4.0-11	7.9-8.4	1-5	0	0	0

Water Features

The table "Water Features" gives estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

The *months* in the table indicate the portion of the year in which the feature is most likely to be a concern.

Water table refers to a saturated zone in the soil. The table indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the

relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Soil Survey of Canadian County, Oklahoma

Water Features

(Depths of layers are in feet. See text for definitions of terms used in this table.
Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Hydro- logic group	Month	Water table		Flooding	
			Upper limit	Lower limit	Duration	Frequency
BeA: Bethany-----	C	All months	---	---	---	---
BnC: Binger-----	B	All months	---	---	---	---
Br: Brewer-----	C	April	---	---	Very brief	Rare
		May	---	---	Very brief	Rare
		June	---	---	Very brief	Rare
		July	---	---	Very brief	Rare
		August	---	---	Very brief	Rare
		September	---	---	Very brief	Rare
		October	---	---	Very brief	Rare
		November	---	---	Very brief	Rare
Bu: Brewer-----	C	April	---	---	Very brief	Rare
		May	---	---	Very brief	Rare
		June	---	---	Very brief	Rare
		July	---	---	Very brief	Rare
		August	---	---	Very brief	Rare
		September	---	---	Very brief	Rare
		October	---	---	Very brief	Rare
		November	---	---	Very brief	Rare
Drummond-----	D	January	2.0-4.0	>6.0	---	---
		February	2.0-4.0	>6.0	---	---
		March	2.0-4.0	>6.0	---	---
		April	2.0-4.0	>6.0	Very brief	Rare
		May	---	---	Very brief	Rare
		June	---	---	Very brief	Rare
		July	---	---	Very brief	Rare
		August	---	---	Very brief	Rare
		September	---	---	Very brief	Rare
		October	---	---	Very brief	Rare
		November	2.0-4.0	>6.0	Very brief	Rare
		December	2.0-4.0	>6.0	---	---
Ca: Canadian-----	B	April	---	---	Very brief	Rare
		May	---	---	Very brief	Rare
		June	---	---	Very brief	Rare
		July	---	---	Very brief	Rare
		August	---	---	Very brief	Rare
		September	---	---	Very brief	Rare
		October	---	---	Very brief	Rare
		November	---	---	Very brief	Rare

Soil Survey of Canadian County, Oklahoma

Water Features—Continued

Map symbol and soil name	Hydro- logic group	Month	Water table		Flooding	
			Upper limit	Lower limit	Duration	Frequency
Da: Dale-----	B	April	---	---	Very brief	Rare
		May	---	---	Very brief	Rare
		June	---	---	Very brief	Rare
		July	---	---	Very brief	Rare
		August	---	---	Very brief	Rare
		September	---	---	Very brief	Rare
		October	---	---	Very brief	Rare
		November	---	---	Very brief	Rare
DAM. Large dam						
DnD, DnF: Darnell-----	C	All months	---	---	---	---
Noble-----	B	All months	---	---	---	---
DuD: Dill-----	B	All months	---	---	---	---
Ironmound-----	C	All months	---	---	---	---
DUM. Dumps						
Ga: Gracemore-----	C	January	0.5-1.5	>6.0	---	---
		February	0.5-1.5	>6.0	---	---
		March	0.5-1.5	>6.0	Very brief	Occasional
		April	0.5-1.5	>6.0	Very brief	Occasional
		May	0.5-1.5	>6.0	Very brief	Occasional
		June	---	---	Very brief	Occasional
		July	---	---	Very brief	Occasional
		August	---	---	Very brief	Occasional
		September	---	---	Very brief	Occasional
		October	---	---	Very brief	Occasional
		November	0.5-1.5	>6.0	---	---
		December	0.5-1.5	>6.0	---	---
Gb: Gracemore-----	C	January	0.5-1.5	>6.0	---	---
		February	0.5-1.5	>6.0	---	---
		March	0.5-1.5	>6.0	Very brief	Frequent
		April	0.5-1.5	>6.0	Very brief	Frequent
		May	0.5-1.5	>6.0	Very brief	Frequent
		June	---	---	Very brief	Frequent
		July	---	---	Very brief	Frequent
		August	---	---	Very brief	Frequent
		September	---	---	Very brief	Frequent
		October	---	---	Very brief	Frequent
		November	0.5-1.5	>6.0	---	---
		December	0.5-1.5	>6.0	---	---

Soil Survey of Canadian County, Oklahoma

Water Features—Continued

Map symbol and soil name	Hydro- logic group	Month	Water table		Flooding	
			Upper limit	Lower limit	Duration	Frequency
GdB, GdC, GdC2, GdD, GdD3: Konawa-----	B	All months	---	---	---	---
GhB: Grant-----	B	All months	---	---	---	---
Pawhuska-----	D	All months	---	---	---	---
GpE: Grant-----	B	All months	---	---	---	---
Port-----	B	March	---	---	Brief	Frequent
		April	---	---	Brief	Frequent
		May	---	---	Brief	Frequent
		June	---	---	Brief	Frequent
		July	---	---	Brief	Frequent
		August	---	---	Brief	Frequent
		September	---	---	Brief	Frequent
		October	---	---	Brief	Frequent
GuD, GuD2: Grant-----	B	All months	---	---	---	---
Ironmound-----	C	All months	---	---	---	---
KfB, KfC: Kingfisher-----	B	All months	---	---	---	---
KrA, KrB: Kirkland-----	D	All months	---	---	---	---
KsB: Kirkland-----	D	All months	---	---	---	---
Pawhuska-----	D	All months	---	---	---	---
KwD: Konawa-----	B	All months	---	---	---	---
Mc: McLain-----	C	April	---	---	Very brief	Rare
		May	---	---	Very brief	Rare
		June	---	---	Very brief	Rare
		July	---	---	Very brief	Rare
		August	---	---	Very brief	Rare
		September	---	---	Very brief	Rare
		October	---	---	Very brief	Rare
		November	---	---	Very brief	Rare

Soil Survey of Canadian County, Oklahoma

Water Features—Continued

Map symbol and soil name	Hydro- logic group	Month	Water table		Flooding	
			Upper limit	Lower limit	Duration	Frequency
MnD, MnF, MsB, MsC: Minco-----	B	All months	---	---	---	---
M-W. Miscellaneous water						
NaD, NaD2, NaD3: Nash-----	B	All months	---	---	---	---
Ironmound-----	C	All months	---	---	---	---
NbC: Noble-----	B	All months	---	---	---	---
NrB, NrC, NrD: Norge-----	B	All months	---	---	---	---
PIT. Pits						
PkA, PkB: Pond Creek-----	B	All months	---	---	---	---
Po: Port-----	B	March	---	---	Brief	Occasional
		April	---	---	Brief	Occasional
		May	---	---	Brief	Occasional
		June	---	---	Brief	Occasional
		July	---	---	Brief	Occasional
		August	---	---	Brief	Occasional
		September	---	---	Brief	Occasional
		October	---	---	Brief	Occasional
Pw: Port-----	B	March	---	---	Brief	Frequent
		April	---	---	Brief	Frequent
		May	---	---	Brief	Frequent
		June	---	---	Brief	Frequent
		July	---	---	Brief	Frequent
		August	---	---	Brief	Frequent
		September	---	---	Brief	Frequent
		October	---	---	Brief	Frequent
QdE: Ironmound-----	C	All months	---	---	---	---
Dill-----	B	All months	---	---	---	---

Soil Survey of Canadian County, Oklahoma

Water Features—Continued

Map symbol and soil name	Hydro- logic group	Month	Water table		Flooding	
			Upper limit	Lower limit	Duration	Frequency
QrF:						
Ironmound-----	C	All months	---	---	---	---
Rock outcrop-----	D	All months	---	---	---	---
Ra:						
Reinach-----	B	April	---	---	Very brief	Rare
		May	---	---	Very brief	Rare
		June	---	---	Very brief	Rare
		July	---	---	Very brief	Rare
		August	---	---	Very brief	Rare
		September	---	---	Very brief	Rare
		October	---	---	Very brief	Rare
		November	---	---	Very brief	Rare
RbA, RbB, RcC2:						
Renfrow-----	D	All months	---	---	---	---
ShB, ShC, ShD, ShD2:						
Lovedale-----	B	All months	---	---	---	---
SnE:						
Lovedale-----	B	All months	---	---	---	---
Wisby-----	B	All months	---	---	---	---
Tv:						
Goodnight-----	A	All months	---	---	---	---
VeC:						
Grainola-----	D	All months	---	---	---	---
VrE:						
Grainola-----	D	All months	---	---	---	---
Rock outcrop-----	D	All months	---	---	---	---
VsC2:						
Grainola-----	D	All months	---	---	---	---
W. Water						

Soil Survey of Canadian County, Oklahoma

Water Features—Continued

Map symbol and soil name	Hydro- logic group	Month	Water table		Flooding	
			Upper limit	Lower limit	Duration	Frequency
Wa: Watonga-----	D	April	---	---	Very brief	Rare
		May	---	---	Very brief	Rare
		June	---	---	Very brief	Rare
		July	---	---	Very brief	Rare
		August	---	---	Very brief	Rare
		September	---	---	Very brief	Rare
		October	---	---	Very brief	Rare
		November	---	---	Very brief	Rare
Ya: Yahola-----	B	April	---	---	Brief	Occasional
		May	---	---	Brief	Occasional
		June	---	---	Brief	Occasional
		July	---	---	Brief	Occasional
		August	---	---	Brief	Occasional
		September	---	---	Brief	Occasional
		October	---	---	Brief	Occasional

Soil Features

The table "Soil Features" gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the hardness and thickness of the restrictive layer, both of which significantly affect the ease of excavation. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Kind	Restrictive layer		Potential for frost action	Risk of corrosion	
		Depth to top	Thickness		Uncoated steel	Concrete
		In	In			
BeA: Bethany-----	---	80-80	---	None	High	Low
BnC: Binger-----	Bedrock (paralithic)	20-40	---	None	Moderate	Low
Br: Brewer-----	---	80-80	---	None	High	Moderate
Bu: Brewer-----	---	80-80	---	None	High	Moderate
Drummond-----	---	80-80	---	None	High	High
Ca: Canadian-----	---	80-80	---	None	Low	Low
Da: Dale-----	---	80-80	---	None	Moderate	Low
DAM. Large dam						
DnD, DnF: Darnell-----	Bedrock (paralithic)	10-20	---	None	Low	Moderate
Noble-----	---	80-80	---	None	Low	Low
DuD: Dill-----	Bedrock (paralithic)	20-40	---	None	Low	Low
Ironmound-----	Bedrock (paralithic)	10-20	---	None	Low	Low
DUM. Dumps						
Ga, Gb: Gracemore-----	---	80-80	---	None	Moderate	Low

Soil Survey of Canadian County, Oklahoma

Soil Features-Continued

Map symbol and soil name	Kind	Restrictive layer		Potential for frost action	Risk of corrosion	
		Depth to top	Thickness		Uncoated steel	Concrete
		In	In			
GdB, GdC, GdC2, GdD, GdD3: Konawa-----	---	80-80	---	None	Moderate	Moderate
GhB: Grant-----	Bedrock (paralithic)	40-60	---	None	Moderate	Low
Pawhuska-----	---	80-80	---	None	High	High
GpE: Grant-----	Bedrock (paralithic)	40-60	---	None	Moderate	Low
Port-----	---	80-80	---	None	Moderate	Low
GuD, GuD2: Grant-----	Bedrock (paralithic)	40-60	---	None	Moderate	Low
Ironmound-----	Bedrock (paralithic)	10-20	---	None	Low	Low
KfB, KfC: Kingfisher-----	Bedrock (paralithic)	20-40	---	None	Moderate	Low
KrA, KrB: Kirkland-----	Bedrock (paralithic)	60-99	---	None	High	Low
KsB: Kirkland-----	Bedrock (paralithic)	60-99	---	None	High	Low
Pawhuska-----	---	80-80	---	None	High	High
KwD: Konawa-----	---	80-80	---	None	Moderate	Moderate
Mc: McLain-----	---	80-80	---	None	High	Low
MnD, MnF, MsB, MsC: Minco-----	---	80-80	---	None	Low	Low

Soil Features—Continued

Map symbol and soil name	Kind	Restrictive layer		Potential for frost action	Risk of corrosion	
		Depth to top	Thickness		Uncoated steel	Concrete
		In	In			
M-W. Miscellaneous water						
NaD, NaD2, NaD3: Nash-----	Bedrock (paralithic)	20-40	---	None	Low	Low
Ironmound-----	Bedrock (paralithic)	10-20	---	None	Low	Low
NbC: Noble-----	---	80-80	---	None	Low	Low
NrB, NrC, NrD: Norge-----	---	80-80	---	None	Moderate	Low
PIT. Pits						
PkA, PkB: Pond Creek-----	---	80-80	---	None	Moderate	Moderate
Po, Pw: Port-----	---	80-80	---	None	Moderate	Low
QdE: Ironmound-----	Bedrock (paralithic)	10-20	---	None	Low	Low
Dill-----	Bedrock (paralithic)	20-40	---	None	Low	Low
QrF: Ironmound-----	Bedrock (paralithic)	10-20	---	None	Low	Low
Rock outcrop-----	Bedrock (paralithic)	0-3	---	None	---	---
Ra: Reinach-----	---	80-80	---	None	Low	Low
RbA, RbB, RcC2: Renfrow-----	---	80-80	---	None	High	Low
ShB, ShC, ShD, ShD2: Lovedale-----	---	80-80	---	None	Low	Moderate

Soil Features—Continued

Map symbol and soil name	Kind	Restrictive layer			Potential for frost action	Risk of corrosion	
		Depth to top	Thickness	Hardness		Uncoated steel	Concrete
		In	In				
SnE: Lovedale-----	---	80-80	---	---	None	Low	Moderate
Wisby-----	---	80-80	---	---	None	Low	Low
Tv: Goodnight-----	---	80-80	---	---	None	Low	Low
VeC: Grainola-----	Bedrock (paralithic)	20-40	---	---	None	High	Low
VrE: Grainola-----	Bedrock (paralithic)	20-40	---	---	None	High	Low
Rock outcrop-----	Bedrock (paralithic)	0-3	---	---	None	---	---
VsC2: Grainola-----	Bedrock (paralithic)	20-40	---	---	None	High	Low
W. Water							
Wa: Watonga-----	---	80-80	---	---	None	High	Low
Ya: Yahola-----	---	80-80	---	---	None	Low	Low

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (7, 9). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. The table "Classification of the Soils" at the end of this section shows the classification of each of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning dry, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustolls (*Argi*, meaning argillic horization, plus *ustoll*, the suborder of the Mollisols that has an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. An example is Udic Argiustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, superactive, thermic Udic Argiustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each

soil series. In addition, the physiographic region, province, and subprovince of each series is specified (3). A pedon, a small three-dimensional area of soil, which is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (6). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (9) and "Keys to Soil Taxonomy" (7). Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Bethany Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Well drained

Parent material and geologic age: Alluvium or loess of Pleistocene age over shale of Permian age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Terrace

Landform position: Tread

Slope range: 0 to 5 percent

Slope shape: Linear-linear

Elevation range: 950 to 1,250 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free days: 190 to 220

Thorntwaite PE index: 44 to 64

Taxonomic class: Fine, mixed, superactive, thermic Pachic Paleustolls

Associated Soils

- Pond Creek soils which have less than 35 percent clay in the control section; on landscapes similar to those of the Bethany soils
- Renfrow soils which have COLE value of 0.07 or more and have a mollic epipedon less than 20 inches thick; on landscapes similar to those of the Bethany soils
- Kirkland soils which have an abrupt textural change from the A horizon to the Bt horizon and have COLE value of 0.07 or more; on landscapes similar to those of the Bethany soils
- Norge and Vanoss soils which have a mollic epipedon less than 20 inches thick and have less than 35 percent clay in the control section; on landscapes similar to those of the Bethany soils
- Tabler soils which have COLE value of 0.07 or more, have redoximorphic accumulations and depletions in the Bt horizon, and have smectitic mineralogy; on the same landscape as the Bethany soils but in the slightly lower positions

Typical Pedon

Bethany silt loam, cultivated; Oklahoma County, Oklahoma; about 1 mile east of Wheatland, 1,000 feet north and 200 feet east of the southwest corner of sec. 28, T. 11 N., R. 4 W. (Colors are for dry soil unless otherwise stated.)

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; slightly acid; clear smooth boundary. (0 to 10 inches thick)

- A—6 to 14 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable; many fine roots; slightly acid; gradual smooth boundary. (6 to 20 inches thick)
- BA—14 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, firm; many fine roots; neutral; clear smooth boundary. (3 to 10 inches thick)
- Bt1—18 to 36 inches; dark brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; strong fine and medium blocky structure; very hard, very firm; clay films on faces of peds; common fine roots; slightly alkaline; gradual smooth boundary. (10 to 25 inches thick)
- Bt2—36 to 56 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate medium and coarse blocky structure; very hard, very firm; clay films on faces of peds; few fine roots; common fine concretions of iron-manganese; few fine concretions of calcium carbonate; moderately alkaline; gradual smooth boundary. (10 to 30 inches thick)
- Bt3—56 to 72 inches; brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; common fine and coarse distinct yellowish red (5YR 5/6) and reddish brown (5YR 5/4) redoximorphic features; moderate medium and coarse blocky structure; very hard, very firm; patchy clay films on faces of peds; few fine roots; common fine concretions of iron-manganese; few soft accumulations of secondary lime; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary. (10 to 20 inches thick)
- Bt4—72 to 80 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; weak medium blocky structure; very hard, very firm; patchy clay films on faces of peds; common coarse distinct brown (7.5YR 5/4) and red (2.5YR 5/6) redoximorphic features; few fine concretions of calcium carbonate; calcareous; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: More than 20 inches

Thickness of the solum: More than 60 inches

Depth to bedrock: More than 80 inches

Depth to carbonates: 28 to 40 inches

A horizon:

Color—hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 2 or 3

Texture—silt loam or silty clay loam

Reaction—strongly acid to neutral

Electrical conductivity of the saturation extract—0 to 1 mmho/cm

Roots—many, fine

Clay content—15 to 35 percent

Thickness—8 to 20 inches

BA horizon (if it occurs):

Color—hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 or 3

Texture—silty clay loam or clay loam

Reaction—slightly acid to slightly alkaline

Electrical conductivity of the saturation extract—0 to 1 mmho/cm

Roots—many, fine

Clay content—27 to 35 percent

Thickness—3 to 10 inches

Bt1 horizon:

Color—hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 or 3

Texture—clay, silty clay, clay loam, or silty clay loam

Reaction—neutral to moderately alkaline

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Electrical conductivity of the saturation extract—0 to 1 mmho/cm
Roots—common, fine
Clay content—35 to 50 percent
Thickness—10 to 25 inches

Bt2 horizon:

Color—hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6
Texture—clay, silty clay, clay loam, or silty clay loam
Reaction—neutral to moderately alkaline
Electrical conductivity of the saturation extract—0 to 4 mmhos/cm
Sodium adsorption ratio—0 to 8
Roots—few, fine
Redoximorphic features—few or common accumulations in shades of brown
Clay content—35 to 50 percent
Thickness—10 to 30 inches

Bt3 horizon:

Color—hue of 5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6
Texture—clay, silty clay, clay loam, or silty clay loam
Reaction—slightly alkaline or moderately alkaline
Electrical conductivity of the saturation extract—0 to 4 mmhos/cm
Clay content—35 to 50 percent
Redoximorphic features—concentrations in shades of red, yellow, and brown;
depletions in shades of gray
Sodium adsorption ratio—0 to 8
Roots—many, fine
Thickness—8 to 20 inches

Bt4 horizon:

Color—hue of 5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6
Texture—clay, silty clay, clay loam, or silty clay loam
Reaction—neutral to moderately alkaline
Clay content—35 to 50 percent
Redoximorphic features—concentrations in shades of red, yellow, and brown;
depletions in shades of gray

Binger Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Moderately deep

Drainage class: Well drained

Parent material and geologic age: Weakly cemented sandstone of Permian age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Hill

Landform position: Summit and backslope

Slope range: 1 to 8 percent

Slope shape: Convex-convex

Elevation range: 800 to 1,500 feet

Mean annual precipitation: 28 to 40 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free days: 190 to 230

Thorntwaite PE index: 44 to 64

Taxonomic class: Fine-loamy, mixed, active, thermic Udic Rhodustalfs

Associated Soils

- Pond Creek soils which have a mollic epipedon and have less than 15 percent material coarser than very fine sand in the control section
- Grant and Norge soils which have a solum that is more than 40 inches thick, have a mollic epipedon, and have less than 15 percent material coarser than very fine sand in the control section
- Nash soils which do not have argillic horizons
- Ironmound soils which have bedrock within a depth of 20 inches

Typical Pedon

Binger fine sandy loam, 3 to 5 percent slopes; Canadian County, Oklahoma; in a cultivated area, about 1 mile east and 1 mile north of Mustang, 220 feet south and 120 feet west of the northeast corner of sec. 27, T. 11 N., R. 5 W. (Colors are for dry soil unless otherwise stated.)

Ap—0 to 10 inches; reddish brown (2.5YR 4/4) fine sandy loam, dark reddish brown (2.5YR 3/4) moist; weak fine granular structure; slightly hard, very friable; many fine roots; neutral; clear smooth boundary. (7 to 15 inches thick)

Bt—10 to 32 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; weak medium prismatic structure parting to weak fine subangular blocky; hard, friable; many fine roots; clay films on faces of peds; neutral; clear wavy boundary. (12 to 25 inches thick)

Cr—32 to 40 inches; red (2.5YR 5/6) weakly cemented sandstone; slightly alkaline.

Range in Characteristics

Thickness of the ochric epipedon: 7 to 15 inches

Thickness of the solum: 20 to 40 inches

Depth to bedrock: 20 to 40 inches

A horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 3 to 6

Texture—fine sandy loam

Reaction—slightly acid to moderately alkaline

Bt horizon:

Color—hue of 2.5YR or 10R, value of 4, and chroma of 4 to 6

Texture—sandy clay loam or fine sandy loam

Reaction—slightly acid to moderately alkaline

Clay content—18 to 25 percent

Content and size of coarse fragments—0 to 10 percent, by volume, rounded gravel less than 3 inches in diameter

Cr horizon:

Color—hue of 2.5YR, value of 5, and chroma of 6

Texture—weakly consolidated sandstone

Reaction—slightly alkaline

Hardness—horizon is mainly nonparalithic with a low or moderate excavation difficulty; some layers are paralithic with a high excavation difficulty

Moist bulk density—1.85 to more than 2.0 gm/cm³

Brewer Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Moderately well drained

Soil Survey of Canadian County, Oklahoma

Parent material and geologic age: Loamy and clayey alluvium of Pleistocene age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Valley

Landform: High flood plain

Slope range: 0 to 1 percent

Slope shape: Linear-linear

Elevation range: 800 to 1,100 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 58 to 63 degrees F

Frost-free days: 200 to 230

Thornthwaite PE index: 44 to 64

Taxonomic class: Fine, mixed, superactive, thermic Udertic Argiustolls

Associated Soils

- Port and Reinach soils which have less than 35 percent clay in the textural control section
- McLain soils which have upper Bt horizons with hues of 5YR or redder

Typical Pedon

Brewer silty clay loam; Pawnee County, Oklahoma; in a pasture, about 1/2 mile north of Pawnee on the east side of Oklahoma Highway 18, about 200 feet east and 900 feet north of the southwest corner of sec. 29, T. 22 N., R. 5 E. (Colors are for dry soil unless otherwise stated.)

A—0 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; hard, friable; slightly acid; gradual smooth boundary. (8 to 16 inches thick)

Bt1—12 to 30 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium and fine subangular blocky structure; very hard, firm; clay films on faces of peds; neutral; gradual smooth boundary. (10 to 22 inches thick)

Bt2—30 to 50 inches; dark brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate medium blocky structure; very hard, firm; clay films on faces of peds; moderately alkaline; gradual smooth boundary. (12 to 27 inches thick)

BC—50 to 80 inches; reddish brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; weak coarse blocky structure; very hard, firm; moderately alkaline; gradual smooth boundary. (15 to 35 inches thick)

Ck—80 to 90 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; massive; very hard, firm; horizon has common fine concretions of calcium carbonate but fine earth is mostly noncalcareous; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: More than 20 inches

Thickness of the solum: 50 to 90 inches

A horizon:

Color—hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 1 or 2

Texture—silty clay loam, clay loam, or silt loam

Reaction—moderately acid to neutral

Clay content—18 to 32 percent

Bt1 and Bt2 horizons:

Color—hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 1 or 2

Texture—clay loam, silty clay loam, silty clay, or clay

Soil Survey of Canadian County, Oklahoma

Reaction—slightly acid to moderately alkaline

Clay content—35 to 55 percent

Redoximorphic features—concentrations in shades of brown; depletions in shades of gray

Btk horizon (if it occurs):

Color—hue of 7.5YR to 10YR, value of 4 or 5, and chroma of 3 or 4

Texture—silty clay loam, silty clay, or clay

Reaction—neutral to moderately alkaline

Clay content—35 to 55 percent

BC horizon:

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 to 4

Texture—loam, silty clay loam, clay loam, or clay

Reaction—neutral to moderately alkaline

Clay content—25 to 40 percent

C horizon (if it occurs):

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 to 4

Texture—loam, silty clay loam, clay loam, or clay

Reaction—neutral to moderately alkaline

Clay content—18 to 40 percent

Canadian Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Well drained

Parent material and geologic age: Loamy alluvium of Pleistocene age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Valley

Landform: High flood plain

Slope range: 0 to 3 percent

Slope shape: Linear-linear

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 58 to 64 degrees F

Frost-free days: 200 to 230

Thorntwaite PE index: 44 to 64

Taxonomic class: Coarse-loamy, mixed, superactive, thermic Udic Haplustolls

Associated Soils

- Dale soils which have a mollic epipedon more than 20 inches thick and have more than 18 percent clay in the control section; adjacent to the Canadian soils on the same terrace
- Port soils which have a mollic epipedon more than 20 inches thick and have more than 18 percent clay in the control section; in the lower positions on flood plains
- Crisfield soils which have colors of 5YR hue or redder in the control section; adjacent to the Canadian soils on the same terrace
- Lela and McLain soils which have more than 35 percent clay in the control section; adjacent to the Canadian soils on the same terrace
- Miller soils which have more than 35 percent clay in the control section; in the lower positions on flood plains

Soil Survey of Canadian County, Oklahoma

- Pulaski and Yahola soils which do not have a mollic epipedon; in the lower positions on flood plains
- Lincoln soils which have a sandy control section and do not have a mollic epipedon; in the lower positions on flood plains
- Reinach soils which have a mollic epipedon more than 20 inches thick and have less than 18 percent clay and less than 15 percent material coarser than very fine sand in the control section; adjacent to the Canadian soils on the same terrace

Typical Pedon

Canadian fine sandy loamy; Oklahoma County, Oklahoma; in a cultivated area, about $\frac{1}{2}$ mile north of the intersection of Reno Avenue and Council Road in Oklahoma City, 2,600 feet north and 830 feet east of the southwest corner of sec. 32, T. 12 N., R. 4 W. (Colors are for dry soil unless otherwise stated.)

- A1—0 to 8 inches; dark grayish brown (10YR 4/2, crushed) fine sandy loam, very dark grayish brown (10YR 3/2, crushed) moist; weak medium platy structure parting to weak fine granular; slightly hard, very friable; many very fine and fine roots; many very fine pores; noneffervescent; neutral; clear smooth boundary. (0 to 10 inches thick)
- A2—8 to 18 inches; dark grayish brown (10YR 4/2, crushed) fine sandy loam, very dark grayish brown (10YR 3/2, crushed) moist; weak medium granular structure; slightly hard, very friable; many very fine and fine roots; many very fine pores; noneffervescent; slightly alkaline; clear smooth boundary. (8 to 20 inches thick)
- Bw—18 to 28 inches; brown (7.5YR 5/2, crushed) fine sandy loam, brown (7.5YR 4/2, crushed) moist; weak medium subangular blocky structure parting to weak medium granular; slightly hard, very friable; common very fine and fine roots; many very fine pores; noneffervescent; slightly alkaline; gradual wavy boundary. (10 to 35 inches thick)
- C1—28 to 43 inches; strong brown (7.5YR 5/6, crushed) fine sandy loam, strong brown (7.5YR 4/6, crushed) moist; massive; slightly hard, very friable; common very fine and few fine roots; noneffervescent; slightly alkaline; gradual wavy boundary. (12 to 20 inches thick)
- C2—43 to 52 inches; yellowish red (5YR 5/6, crushed) fine sandy loam, yellowish red (5YR 4/6, crushed) moist; massive; slightly hard, very friable; common very fine and few fine roots; noneffervescent; slightly alkaline; gradual smooth boundary. (0 to 20 inches thick)
- C3—52 to 84 inches; reddish yellow (5YR 6/6, crushed) loamy fine sand, yellowish red (5YR 5/6, crushed) moist; single grained; soft, very friable; few very fine and few fine roots; stratified with thin red (2.5YR 4/6, moist) layers; noneffervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches

Thickness of the solum: 20 to 50 inches

Depth to bedrock: More than 80 inches

A or Ap horizon:

Color—hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3

Texture—fine sandy loam, sandy loam, very fine sandy loam, or loam

Reaction—very strongly acid to slightly alkaline

Clay content—5 to 18 percent

Thickness—combined thickness of the A horizon ranges from 7 to 20 inches

Bw horizon:

Color—hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 2 to 6

Texture—fine sandy loam, sandy loam, or loam

Soil Survey of Canadian County, Oklahoma

Reaction—slightly acid to moderately alkaline

Clay content—10 to 18 percent

Thickness—10 to 35 inches

C1 horizon:

Color—hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 3 to 6

Texture—typically fine sandy loam, sandy loam, or loam; loamy fine sand or fine sand is included in some pedons below a depth of 40 inches

Reaction—slightly acid to moderately alkaline

Clay content—5 to 18 percent

Thickness—12 to 20 inches

C2 and C3 horizons:

Color—hue of 5YR to 10YR, value of 5 to 7, and chroma of 3 to 6

Texture—typically fine sandy loam, sandy loam, loam, or loamy fine sand; fine sand is included in some pedons below a depth of 40 inches

Reaction—slightly acid to moderately alkaline

Clay content—5 to 18 percent

Dale Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Well drained

Parent material and geologic age: Loamy alluvium of Pleistocene age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Valley

Landform: High flood plain

Slope range: 0 to 8 percent

Slope shape: Linear-linear

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free days: 200 to 230

Thorntwaite PE index: 44 to 64

Taxonomic class: Fine-silty, mixed, superactive, thermic Pachic Haplustolls

Associated Soils

- Port soils which are on the lower landscapes
- Brewer, Lela, and McLain soils which have more than 35 percent clay in the control section; on landscapes similar to the Dale soils but in the slightly lower positions farther from the stream
- Reinach soils which are on the slightly higher landscapes nearer to the stream
- Canadian and Crisfield soils which have a mollic epipedon less than 20 inches thick and have a coarse-loamy control section; on the slightly higher landscapes nearer to the stream

Typical Pedon

Dale silt loam; Lincoln County, Oklahoma; in a cultivated area, about 1 mile east of Harrah, 4,000 feet south and 900 feet east of the northwest corner of sec. 30, T. 12 N., R. 2 E. (Colors are for dry soil unless otherwise stated.)

- Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; many fine roots; many wormcasts; neutral; abrupt smooth boundary. (0 to 10 inches thick)
- A—7 to 21 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; hard, friable; many fine roots; many wormcasts; neutral; abrupt smooth boundary. (10 to 26 inches thick)
- Bw—21 to 40 inches; dark brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to moderate medium granular; hard, friable; few fine roots; few wormcasts; slightly alkaline; gradual smooth boundary. (10 to 30 inches thick)
- C—40 to 60 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; massive; hard, friable; few fine roots; few wormcasts; few films and spots of calcium carbonate; calcareous; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 20 to 50 inches

Depth to bedrock: More than 80 inches

Depth to carbonates: 20 to 60 inches

A horizon:

Color—hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 or 3

Texture—silt loam, loam, silty clay loam, or clay loam

Reaction—slightly acid to moderately alkaline

Roots—many, fine

Clay content—15 to 35 percent

Thickness—10 to 26 inches

Bw horizon:

Color—hue of 2.5YR to 10YR, value of 3 to 5, and chroma of 2 to 8

Texture—silt loam, loam, silty clay loam, or clay loam

Reaction—slightly acid to moderately alkaline

Roots—few, fine

Clay content—18 to 35 percent

Thickness—10 to 30 inches

C horizon:

Color—hue of 2.5YR to 10YR, value of 4 to 6, and chroma of 2 to 8

Texture—typically silt loam, loam, silty clay loam, or clay loam; strata of very fine sandy loam, fine sandy loam, or loamy fine sand occur in some pedons below a depth of 50 inches

Reaction—slightly acid to moderately alkaline

Roots—few, fine

Clay content—18 to 35 percent

Darnell Series

Major land resource area: Northern Cross Timbers (84A)

Depth class: Shallow

Drainage class: Well drained or somewhat excessively drained

Parent material and geologic age: Sandstone of Permian age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Soil Survey of Canadian County, Oklahoma

Landform: Hill

Landform position: Summit and backslope

Slope range: 1 to 45 percent

Slope shape: Convex-convex

Elevation range: 750 to 1,300 feet

Mean annual precipitation: 28 to 40 inches

Mean annual air temperature: 58 to 64 degrees F

Frost-free days: 200 to 230

Thorntwaite PE index: 44 to 64

Taxonomic class: Loamy, siliceous, active, thermic, shallow Udic Haplustepts

Associated Soils

- Darsil soils which have a textural control section of loamy fine sand or coarser material; intermingled on the same landscape
- Stephenville soils which have a solum that is 20 to 40 inches thick and have Bt horizons; on broad flat summits, shoulders, or backslopes
- Harrah soils which have a solum more than 60 inches thick and have Bt horizons; on broad flat summits, shoulders, or backslopes
- Littleaxe soils which have a solum that is 40 to 60 inches thick and have Bt horizons; on broad flat summits, shoulders, or backslopes
- Newalla and Niotaze soils which have Bt horizons, have a fine control section, and have a solum more than 20 inches thick; on broad flats or upper side slopes

Typical Pedon

Darnell fine sandy loam; Lincoln County, Oklahoma; in scrub oak forest, about 8 miles west of Tryon, 900 feet west and 100 feet north of the southeast corner of sec. 17, T. 16 N., R. 2 E. (Colors are for dry soil unless otherwise stated.)

A—0 to 5 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; many roots; moderately acid; gradual smooth boundary. (4 to 10 inches thick)

Bw—5 to 15 inches; light brown (7.5YR 6/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; many roots; few fragments of sandstone less than 1 inch in diameter; moderately acid; gradual wavy boundary. (4 to 12 inches thick)

Cr—15 to 30 inches; red (2.5YR 4/6) sandstone, dark red (2.5YR 3/6) moist; difficult to auger; moderately acid.

Range in Characteristics

Thickness of the ochric epipedon: 4 to 10 inches

Thickness of the solum: 10 to 20 inches

Depth to bedrock: 10 to 20 inches

A horizon:

Color—hue of 5YR to 10YR, value of 4 to 6, and chroma of 2 to 4

Texture—fine sandy loam, sandy loam, loam, stony fine sandy loam, or stony loam

Reaction—neutral to strongly acid

Clay content—10 to 20 percent

Content and size of coarse fragments—0 to 20 percent, by volume (0 to 5 percent are less than 3 inches in diameter and 0 to 15 percent are 3 to 10 inches in diameter)

Bw horizon:

Color—hue of 2.5YR to 10YR, value of 4 to 8, and chroma of 2 to 6

Texture—fine sandy loam, sandy loam, gravelly fine sandy loam, or gravelly loam

Reaction—strongly acid to neutral

Clay content—10 to 25 percent

Content and size of coarse fragments—0 to 20 percent, by volume (0 to 20 percent are less than 3 inches in diameter and 0 to 5 percent are 3 to 10 inches in diameter)

Cr horizon:

Color—hue of 10R to 10YR, value of 4 to 7, and chroma of 3 to 8

Texture—weakly to strongly consolidated sandstone

Excavation difficulty—high or very high

Reaction—strongly acid to neutral

Other characteristics—fractures that are more than 10 cm apart; horizon is root restrictive

Dill Series

Major land resource area: Central Rolling Red Plains (78C)

Depth class: Moderately deep

Drainage class: Well drained

Parent material and geologic age: Residuum weathered from noncalcareous sandstone of Permian age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Hill

Landform position: Summit and backslope

Slope range: 0 to 12 percent

Slope shape: Convex-convex

Elevation range: 1,000 to 2,000 feet

Mean annual precipitation: 22 to 28 inches

Mean annual air temperature: 57 to 65 degrees F

Frost-free days: 185 to 230

Thornthwaite PE index: 33 to 44

Taxonomic class: Coarse-loamy, mixed, active, thermic Udic Haplustepts

Associated Soils

- Cordell and Quinlan soils which have a solum less than 20 inches thick; mainly on summits
- Grandfield soils which have an argillic horizon; on adjacent, slightly higher convex ridges
- Woodward soils which have a coarse-silty control section; on adjacent, slightly lower side slopes

Typical Pedon

Dill fine sandy loam; Washita County, Oklahoma; in pasture, about 1 mile south and 1/2 mile east of Canute, 1,930 feet east and 45 feet north of the southwest corner of sec. 24, T. 11 N., R. 20 W. (Colors are for dry soil unless otherwise stated.)

A—0 to 12 inches; reddish brown (2.5YR 4/4) fine sandy loam, dark reddish brown (2.5YR 3/4) moist; very weak fine granular structure; slightly hard, very friable; neutral; gradual smooth boundary. (6 to 16 inches thick)

Bw—12 to 32 inches; red (2.5YR 4/6) fine sandy loam, dark red (2.5YR 3/6) moist; weak medium subangular blocky structure; slightly hard, very friable; few

fragments of soft sandstone in the lower 6 inches of horizon; neutral; abrupt irregular boundary. (8 to 38 inches thick)
Cr—32 to 40 inches; weakly cemented noncalcareous red (10R 4/6) sandstone.

Range in Characteristics

Thickness of the solum: 20 to 40 inches

A horizon:

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4
Texture—loam, fine sandy loam, very fine sandy loam, or loamy fine sand
Reaction—slightly acid to slightly alkaline
Clay content—8 to 18 percent
Organic carbon—less than 0.6 percent when reddish brown (5YR 4/3, 5/3) color is present

Bw horizon:

Color—hue of 10R to 5YR, value of 4 or 5, and chroma of 4 to 6
Texture—loam, fine sandy loam, or very fine sandy loam
Reaction—slightly acid to slightly alkaline
Clay content—8 to 18 percent

Cr horizon:

Color—hue of 10R to 5YR, value of 4 or 5, and chroma of 4 to 6
Texture—weakly cemented sandstone
Reaction—slightly acid to moderately alkaline; noncalcareous

Drummond Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Somewhat poorly drained

Parent material and geologic age: Residuum weathered from loamy and clayey alluvium from Permian-age red beds

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Valley

Landform: Terrace

Slope range: 0 to 3 percent

Slope shape: Linear-linear

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 24 to 40 inches

Mean annual air temperature: 59 to 65 degrees F

Frost-free days: 200 to 230

Thornthwaite PE index: 40 to 64

Taxonomic class: Fine, mixed, superactive, thermic Mollic Natrustalfs

Associated Soils

- Miller soils which do not have a natric horizon and have a mollic epipedon; on flood plains
- Port soils which have less than 35 percent clay in the control section and do not have a natric horizon; on flood plains
- Reinach soils which have less than 35 percent clay in the control section and do not have a natric horizon; on terraces at similar elevations but closer to the stream
- Carwile soils which have a mollic epipedon, have redoximorphic features in the lower

mollic epipedon, and do not have a natric horizon; on the higher parts of the landscape

- Eda and Lovedale soils which have less than 35 percent clay in the control section and do not have a natric horizon; on the higher parts of the landscape
- Meno soils which have an A horizon more than 20 inches thick, do not have a natric horizon, and have less than 35 percent clay in the control section; on the higher parts of the landscape
- Tabler soils which have a mollic epipedon and do not have a natric horizon; on the higher parts of the landscape

Typical Pedon

Drummond loam; Garfield County, Oklahoma; in rangeland, 3 miles northwest of Drummond, 200 feet south and 50 feet east of the northwest corner of sec. 8, T. 21 N., R. 8 W. (Colors are for dry soil unless otherwise stated.)

- A—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; common fine roots and pores; the upper $\frac{1}{2}$ inch of horizon is vesicular and crusted; slightly alkaline; clear wavy boundary. (3 to 15 inches thick)
- Btn—8 to 22 inches; brown (7.5YR 5/2) clay loam, dark brown (7.5YR 4/2) moist; weak medium columnar structure; very hard, very firm; few fine roots and pores; continuous clay films on faces of pedis; few fine concretions of calcium carbonate; common fine white crystals occur below a depth of 15 inches; moderately alkaline; clear smooth boundary. (10 to 30 inches thick)
- BC—22 to 30 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; weak coarse prismatic structure; very hard, very firm; few fine pores; few fine concretions of calcium carbonate; few fine distinct strong brown redoximorphic concentrations; calcareous; moderately alkaline; gradual smooth boundary. (4 to 20 inches thick)
- C—30 to 60 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; massive; hard, friable; thin strata ranging from sandy loam to clay; calcareous; moderately alkaline.

Range in Characteristics

Thickness of the ochric epipedon: 3 to 15 inches

Thickness of the solum: 20 to 60 inches

Depth to carbonates: 10 to 30 inches

A or Ap horizon:

Color—hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 1 to 3

Texture—loam, silt loam, clay loam, or fine sandy loam

Reaction—slightly acid to moderately alkaline

Exchangeable sodium percent—0 to 15

Electrical conductivity of the saturation extract—1 to 16 mmhos/cm

Btn horizon:

Color—hue of 7.5YR to 5Y, value of 4 to 7, and chroma of 1 to 4

Texture—silty clay loam, clay loam, or clay

Reaction—neutral to strongly alkaline

Clay content—35 to 60 percent

Exchangeable sodium percent—15 to 100

Electrical conductivity of the saturation extract—2 to 16 mmhos/cm

BC horizon:

Color—hue of 5YR to 5Y, value of 4 to 7, and chroma of 1 to 4

Texture—clay loam, silty clay loam, or clay

Reaction—slightly alkaline to strongly alkaline

Clay content—27 to 45 percent

Redoximorphic features—concentrations in shades of red or brown; depletions in shades of gray

Exchangeable sodium percent—15 to 25

Electrical conductivity of the saturation extract—2 to 16 mmhos/cm

C horizon:

Color—hue of 5YR to 5Y, value of 4 to 7, and chroma of 1 to 4

Texture—fine sandy loam with thin layers of coarser and finer textured material

Reaction—slightly alkaline to strongly alkaline

Clay content—5 to 30 percent

Goodnight Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Excessively drained

Parent material and geologic age: Sandy eolian sediments of Recent age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Valley

Landform: Dunefield

Secondary landform: Dune

Slope range: 0 to 30 percent

Slope shape: Convex-convex

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 58 to 64 degrees F

Frost-free days: 200 to 230

Thorndthwaite PE index: 44 to 64

Taxonomic class: Mixed, thermic Typic Ustipsamments

Associated Soils

- Derby soils which have lamellae that begin within a depth of 2 meters; at the higher elevations
- Gaddy soils which have strata of finer texture within the control section; on the lower flood plains adjacent to the Goodnight soils
- Amber and Reinach soils which are coarse-silty; on flood plains
- Gracemore soils which have thin strata of finer textures in the control section; on flood plains
- Miller soils which have a fine control section; on flood plains
- Yahola soils which have a coarse-loamy control section; on flood plains

Typical Pedon

Goodnight loamy fine sand; Payne County, Oklahoma; in rangeland, 5 miles north on Oklahoma Highway 18 and 1 mile east of Cushing, 600 feet south and 200 feet east of the northwest corner of sec. 11, T. 18 N., R. 5 E. (Colors are for dry soil unless otherwise stated.)

A—0 to 5 inches; brown (7.5YR 5/3) loamy fine sand, brown (7.5YR 4/3) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary. (4 to 14 inches thick)

AC1—5 to 16 inches; light brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist;

single grained; loose; slightly acid; gradual wavy boundary. (0 to 28 inches thick)
AC2—16 to 40 inches; reddish yellow (7.5YR 7/6) fine sand, reddish yellow (7.5YR 6/6) moist; single grained; loose; neutral; clear smooth boundary. (0 to 36 inches thick)
C—40 to 80 inches; reddish yellow (7.5YR 7/6) fine sand, reddish yellow (7.5YR 6/6) moist; single grained; loose; bedding strata and some cross-bedding; calcareous; moderately alkaline.

Range in Characteristics

Thickness of the ochric epipedon: 4 to 14 inches

Thickness of the solum: 10 to 60 inches

Depth to bedrock: More than 80 inches

A or Ap horizon:

Color—hue of 5YR to 10YR, value of 4 to 6, and chroma of 2 to 4

Texture—loamy fine sand or fine sand

Reaction—slightly acid to moderately alkaline

Clay content—2 to 12 percent

AC1 horizon:

Color—hue of 5YR to 10YR, value of 5 to 7, and chroma of 3 to 6

Texture—loamy fine sand or fine sand

Reaction—slightly acid to moderately alkaline

Clay content—2 to 12 percent

AC2 horizon:

Color—hue of 5YR or 7.5YR, value of 5 to 8, and chroma of 4 to 8

Texture—loamy fine sand or fine sand

Reaction—neutral to moderately alkaline

Clay content—2 to 12 percent

C horizon:

Color—hue of 5YR or 7.5YR, value of 5 to 8, and chroma of 4 to 8

Texture—loamy fine sand or fine sand

Reaction—neutral to moderately alkaline

Clay content—2 to 12 percent

Other characteristics—common thin cross-bedding strata of eolian material; sandy alluvial sediments with loamy strata occur in some pedons below a depth of 60 inches

Gracemore Series

Major land resource area: Central Rolling Red Plains (78C) and Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Somewhat poorly drained

Parent material and geologic age: Calcareous sandy alluvium of Recent age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Valley

Landform: Low flood plain

Slope range: 0 to 3 percent

Slope shape: Linear-linear/concave

Elevation range: 700 to 1,300 feet

Mean annual precipitation: 24 to 38 inches

Soil Survey of Canadian County, Oklahoma

Mean annual air temperature: 57 to 63 degrees F

Frost-free days: 190 to 230

Thornthwaite PE index: 34 to 64

Taxonomic class: Sandy, mixed, thermic Oxyaquic Udifluvents

Associated Soils

- Daycreek soils which do not have an irregular decrease in organic matter with increasing depth; in areas adjacent to but not on flood plains
- Ezell soils which have a water table within a depth of 12 inches and pond water for long periods of time
- Gaddy soils which do not have a water table within a depth of 40 inches most of the year and are dry for longer periods of time; in the slightly higher positions
- Gracemont soils which have fine sandy loam horizons below a depth of 10 inches; in landscape positions similar to those of the Gracemore soils
- Heman soils which have strongly contrasting particle-size classes in the control section; in the slightly higher landscape positions
- Goodnight and Jester soils which consist of eolian sediments in dune areas and do not have a water table
- Lincoln soils which do not have a water table within a depth of 40 inches most of the year and are dry for longer periods of time; in the slightly higher positions
- Westola and Yahola soils which have fine sandy loam horizons below a depth of 10 inches, do not have a water table within a depth of 40 inches most of the year, and are dry for longer periods of time; in the slightly higher positions
- Port soils which have a mollic epipedon, have a fine-silty control section, and do not have a water table within a depth of 40 inches

Typical Pedon

Gracemore loamy fine sand, 0 to 1 percent slopes, occasionally flooded; Canadian County, Oklahoma; about 12 miles west and 6 miles south of El Reno, 600 feet north and 300 feet west of the southeast corner of sec. 5, T. 11 N., R. 9 W. (Colors are for moist soil unless otherwise stated.)

A—0 to 12 inches; dark brown (7.5YR 4/4) loamy fine sand, brown (7.5YR 5/4) dry; weak fine granular structure; soft, very friable; many fine roots; calcareous; moderately alkaline; clear smooth boundary.

C—12 to 72 inches; brown (7.5YR 5/4) fine sand, pink (7.5YR 6/4) dry; single grained; loose, very friable; very thin to 1-inch-thick strata of darker colored fine sandy loam and clay loam that decrease in number as depth increases; bedding planes are evident; calcareous; moderately alkaline.

Range in Characteristics

Content and size of coarse fragments: 0 to 10 percent, by volume, rounded gravel as much as 3 inches in diameter occur throughout the profile

Depth to carbonates: 0 to 10 inches

Depth to a fluctuating water table: 6 to 36 inches

A horizon:

Color—hue of 5YR to 10YR, value of 3 to 7 (4 to 8 dry), and chroma of 1 to 6; where moist color value and chroma are 3 or less, the horizon is less than 10 inches thick

Texture—fine sand, loamy fine sand, fine sandy loam, loam, clay loam, or very fine sandy loam in the upper 10 inches; loamy fine sand or fine sand below a depth of 10 inches

Reaction—slightly alkaline or moderately alkaline; calcareous

Electrical conductivity of the saturation extract—0 to 16 mmhos/cm

C horizon:

Color—hue of 5YR to 10YR, value of 4 to 7 (5 to 8 dry), and chroma of 2 to 6; finer strata are darker and contain more organic carbon than the mass of the horizon

Texture—horizon is loamy fine sand or fine sand and is stratified with thin strata of finer material that ranges from fine sandy loam to clay loam

Reaction—moderately alkaline; calcareous

Electrical conductivity of the saturation extract—0 to 16 mmhos/cm

Grainola Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Moderately deep

Drainage class: Well drained

Parent material and geologic age: Material weathered from shale of Recent age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Hill

Landform position: Shoulder and backslope

Slope range: 1 to 25 percent

Slope shape: Linear-convex

Elevation range: 800 to 1,500 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 58 to 64 degrees F

Frost-free days: 200 to 220

Thorntwaite PE index: 44 to 64

Taxonomic class: Fine, mixed, active, thermic Udertic Haplustalfs

Associated Soils

- Foraker soils which have smectitic mineralogy; typically on broad ridges that are slightly higher than areas of the Grainola soils
- Aydelotte soils which have a solum more than 60 inches thick; typically on broad ridges that are slightly higher than areas of the Grainola soils
- Apperson, Corbin, and Renfrow soils which have a mollic epipedon; typically on broad ridges that are slightly higher than areas of the Grainola soils
- Kiti, Lucien, and Shidler soils which are less than 20 inches thick, do not have an argillic horizon, and have a mollic epipedon; on ridgetops
- Masham soils which are less than 20 inches thick; typically in the slightly lower landform positions
- Tamford soils which do not have an argillic horizon; on footslopes
- Piedmont and Renthin soils which have a mollic epipedon; typically in the slightly higher, smoother areas of the landscape

Typical Pedon

Grainola silty clay loam; Osage County, Oklahoma; in rangeland, about 4 miles west and 3 miles north of Shidler, 1,060 feet east and 280 feet south of the northwest corner of sec. 14, T. 27 N., R. 5 E. (Colors are for dry soil unless otherwise stated.)

Ak—0 to 6 inches; reddish brown (5YR 4/3) very gravelly silty clay loam, dark reddish brown (5YR 3/3) moist; strong medium granular structure; hard, friable; about 25 percent, by volume, flat limestone fragments that range from 2 to 76 mm in diameter and about 10 percent flat limestone fragments more than 76 mm in diameter; about 5 percent calcium carbonate concretions that range from 2 to 76

mm in diameter; calcareous; moderately alkaline; clear smooth boundary. (4 to 10 inches thick)

- BAk—6 to 13 inches; reddish brown (5YR 5/3) silty clay loam, reddish brown (5YR 4/3) moist; moderate medium granular structure; hard, firm; about 7 percent, by volume, flat limestone fragments that range from 2 to 76 mm in diameter; about 5 percent calcium carbonate concretions that range from 2 to 76 mm in diameter; calcareous; moderately alkaline; gradual smooth boundary. (0 to 10 inches thick)
- Btk1—13 to 28 inches; reddish brown (2.5YR 4/4) silty clay, dark reddish brown (2.5YR 3/4) moist; common fine light olive gray spots of weathered shale; weak medium blocky structure; very hard, very firm; nearly continuous clay films or pressure faces on faces of peds; about 5 percent, by volume, sandstone fragments that range from 2 to 76 mm in diameter; few calcium carbonate concretions; few masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary. (8 to 16 inches thick)
- Btk2—28 to 36 inches; reddish brown (2.5YR 4/4) very gravelly silty clay, dark reddish brown (2.5YR 3/4) moist; weak medium blocky structure; very hard, very firm; patchy clay films on faces of peds; about 40 percent, by volume, dark reddish brown and olive gray shale fragments that range from 2 to 76 mm in diameter; few calcium carbonate concretions; common masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary. (0 to 16 inches thick)
- Cr—36 to 42 inches; weak red (2.5YR 5/2) shale bedrock; laminated; calcium carbonate films on faces of some fragments; calcareous.

Range in Characteristics

Thickness of the ochric epipedon: 4 to 10 inches

Thickness of the solum: 20 to 40 inches

Depth to bedrock: 20 to 40 inches

A horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 4

Texture—silt loam, loam, silty clay loam, or clay loam or their gravelly, cobbly, bouldery, or stony counterparts

Reaction—neutral to moderately alkaline

Clay content—15 to 35 percent

Content and size of coarse fragments—0 to 55 percent, by volume, coarse fragments of hard limestone or sandstone (0 to 35 percent are less than 76 mm in diameter, 0 to 20 percent are 76 to 250 mm in diameter, and 0 to 20 percent are 250 to 375 mm in diameter)

BA horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 4

Texture—silty clay loam, clay loam, clay, or silty clay or their gravelly, cobbly, stony, or bouldery counterparts

Reaction—moderately alkaline; calcareous

Clay content—35 to 60 percent

Content and size of coarse fragments—0 to 55 percent, by volume, coarse fragments of hard limestone or sandstone (0 to 35 percent are less than 76 mm in diameter, 0 to 20 percent are 76 to 250 mm in diameter, and 0 to 20 percent are 250 to 375 mm in diameter)

Btk1 horizon:

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 8

Texture—silty clay loam, clay loam, clay, or silty clay

Reaction—moderately alkaline; calcareous

Clay content—35 to 60 percent

Soil Survey of Canadian County, Oklahoma

Content and size of coarse fragments—0 to 15 percent, by volume, soft shale fragments less than 76 mm in diameter

Other characteristics—soft shale fragments slake in water within 15 hours

Btk2 horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 8

Texture—clay loam, silty clay loam, clay, or silty clay or their gravelly or very gravelly counterparts

Reaction—moderately alkaline; calcareous

Clay content—35 to 60 percent

Content and size of coarse fragments—5 to 45 percent, by volume, soft shale fragments less than 76 mm in diameter

Carbonates—0 to 10 percent, by volume, masses of calcium carbonate

Other characteristics—soft shale fragments slake in water within 15 hours

BC horizon (if it occurs):

Color—hue of 10R to 5YR, value of 4 to 6, and chroma of 2 to 8

Texture—clay loam, silty clay loam, clay, or silty clay or their gravelly, very gravelly, or extremely gravelly counterparts

Reaction—moderately alkaline; calcareous

Clay content—35 to 60 percent

Content and size of coarse fragments—5 to 70 percent, by volume, soft shale fragments less than 76 mm in diameter

Carbonates—0 to 10 percent, by volume, masses of calcium carbonate

Other characteristics—soft shale fragments slake in water within 15 hours

Cr horizon:

Color—typically hue of 10R to 5YR, value of 3 to 5, and chroma of 2 to 6; in some pedons the horizon is streaked or spotted with grayish, brownish, yellowish, or olive shades

Texture—weathered shale and thin strata of sandstone and limestone

Excavation difficulty—high or very high

Grant Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Deep

Drainage class: Well drained

Parent material and geologic age: Material weathered from silty sandstone or silty shale of Permian age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Dissected terrace

Landform position: Summits, shoulders, and backslopes

Slope range: 0 to 20 percent

Slope shape: Linear-linear/convex

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 65 degrees F

Frost-free days: 190 to 220

Thorntwaite PE index: 44 to 60

Taxonomic class: Fine-silty, mixed, superactive, thermic Udic Argiustolls

Associated Soils

- Bethany soils which have more than 35 percent clay in the textural control section
- Lucien, Nash, and Nashville soils which do not have an argillic horizon and have bedrock within a depth of 40 inches; on side slopes
- Norge soils which are in the lower positions on side slopes
- Pond Creek soils which are in the lower positions on broad flats

Typical Pedon

Grant silt loam; Garfield County, Oklahoma; about 2 miles north and 6 1/2 miles west of Hillsdale, 500 feet south and 100 feet east of the northwest corner of sec. 6, T. 24 S., R. 8 W. (Colors are for dry soil unless otherwise stated.)

Ap—0 to 7 inches; brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, very friable; many fine roots; slightly acid; clear smooth boundary.

A—7 to 12 inches; brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; slightly hard, very friable; many fine roots; slightly acid; gradual smooth boundary.

AB—12 to 16 inches; reddish brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; slightly hard, very friable; many fine roots; neutral; gradual smooth boundary.

Bt—16 to 32 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable; common fine roots; clay films on faces of peds; neutral; gradual smooth boundary.

BC—32 to 47 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; hard, friable; few fine roots; slightly alkaline; gradual smooth boundary.

C—47 to 59 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; massive; hard, friable; few fine roots; common medium fragments of sandstone; calcareous; moderately alkaline; clear smooth boundary.

Cr—59 to 72 inches; red (2.5YR 5/6) weakly consolidated sandstone, red (2.5YR 4/6) moist; calcareous in seams.

Range in Characteristics

Thickness of the solum: 40 to 60 inches

Depth to bedrock: 40 to 60 inches

Depth to carbonates: 30 to 60 inches

A horizon:

Color—hue of 5YR to 10YR, value of 4 or 5 (3 moist), and chroma of 2 or 3

Texture—silt loam, very fine sandy loam, or loam

Reaction—slightly acid to slightly alkaline

AB or BA horizon (if it occurs):

Color—hue of 2.5YR to 7.5YR, value of 4 or 5 (3 or 4 moist), and chroma of 2 to 4

Texture—silt loam, very fine sandy loam, or loam

Reaction—slightly acid to slightly alkaline

Bt horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 or 5 (3 or 4 moist), and chroma of 2 to 8

Texture—silt loam, loam, very fine sandy loam, silty clay loam, or clay loam

Reaction—typically slightly acid to moderately alkaline; calcareous in the lower part of horizon in some pedons

Clay content—18 to 35 percent

BC horizon:

Color—hue of 2.5YR or 5YR, value of 4 to 6 (3 to 5 moist), and chroma of 4 to 8

Texture—silt loam, loam, very fine sandy loam, silty clay loam, or clay loam

Reaction—neutral to moderately alkaline; calcareous in some pedons

C horizon:

Color—hue of 2.5YR or 5YR, value of 4 to 7 (3 to 6 moist), and chroma of 4 to 8

Texture—silt loam, loam, or very fine sandy loam

Reaction—slightly alkaline or moderately alkaline; noncalcareous in some pedons

Content and size of coarse fragments—0 to 20 percent, by volume, sandstone fragments 5 mm to 1 inch in diameter

Cr horizon:

Color and texture—reddish soft bedrock of silty sandstone or silty shale

Reaction—slightly alkaline or moderately alkaline; horizon may or may not be calcareous

Hardness—horizon is mainly non-paralithic with an excavation difficulty of low or moderate; some layers may be paralithic with a high excavation difficulty

Moist bulk density—1.85 to more than 2.0 gm/cm³

Ironmound Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Shallow

Drainage class: Well drained

Parent material and geologic age: Sandstone or sandstone interbedded with siltstone or sandy shale of Permian age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Hill

Landform position: Summit and backslope

Slope range: 1 to 40 percent

Slope shape: Convex-convex

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 58 to 63 degrees F

Frost-free days: 200 to 230

Thorntwaite PE index: 44 to 64

Taxonomic class: Loamy, mixed, active, thermic, shallow Udic Haplustepts

Associated Soils

- Grainola and Piedmont soils which have a solum more than 20 inches thick, have a Bt horizon, and have a fine textured control section; on the lower backslopes
- Coyle and Kingfisher soils which have a solum more than 20 inches thick and have a Bt horizon; on landscapes similar to those of the Ironmound soils
- Masham soils which have a fine textured control section; on the lower backslopes
- Zaneis soils which have a solum more than 20 inches thick and have a Bt horizon; on the higher ridge crests and upper backslopes

Typical Pedon

Ironmound loam; Logan County, Oklahoma; in rangeland, 1 mile west and 2 miles north of Lovell, 500 feet west and 1,300 feet north of the southeast corner of sec. 30, T. 19 N., R. 4 W. (Colors are for dry soil unless otherwise stated.)

- A—0 to 7 inches; reddish brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure parting to moderate medium granular; hard, friable; many very fine and fine roots; common very fine and fine pores; slightly acid; clear smooth boundary. (4 to 8 inches thick)
- Bw—7 to 16 inches; red (2.5YR 4/6) loam, dark red (2.5YR 3/6) moist; moderate medium subangular blocky structure; hard, friable; common very fine and fine roots; common very fine and fine pores; neutral; clear smooth boundary. (5 to 14 inches thick)
- Cr—16 to 40 inches; red (2.5YR 4/6) weathered sandstone, dark red (2.5YR 3/6) moist; neutral.

Range in Characteristics

Thickness of the ochric epipedon: 4 to 8 inches

Thickness of the solum: 10 to 20 inches

Depth to bedrock: 10 to 20 inches

A horizon:

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 2 to 6

Texture—loam, silt loam, very fine sandy loam, or fine sandy loam

Reaction—moderately acid to moderately alkaline

Clay content—10 to 25 percent

Content and size of coarse fragments—0 to 10 percent, by volume, sandstone gravel less than 76 mm in diameter

Bw horizon:

Color—hue of 10R to 5YR, value of 4 or 5, and chroma of 4 to 6

Texture—loam or fine sandy loam

Reaction—slightly acid to moderately alkaline

Clay content—10 to 27 percent

Content and size of coarse fragments—0 to 10 percent, by volume, sandstone gravel less than 76 mm in diameter

Cr horizon:

Color—hue of 10R to 5YR, value of 4 to 6, and chroma of 4 to 8

Texture—weathered sandstone or shale or sandstone interbedded with siltstone or shale

Excavation difficulty—high or very high

Reaction—neutral to moderately alkaline

Kingfisher Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Moderately deep

Drainage class: Well drained

Parent material and geologic age: Loamy material weathered from silty red beds of Permian age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Hill

Landform position: Summit and backslope

Slope range: 0 to 8 percent

Slope shape: Linear-convex

Elevation range: 700 to 1,500 feet

Soil Survey of Canadian County, Oklahoma

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 58 to 63 degrees F

Frost-free days: 200 to 230

Thorntwaite PE index: 44 to 64

Taxonomic class: Fine-silty, mixed, active, thermic Udic Argiustolls

Associated Soils

- Bethany and Grant soils which are on nearby landscapes
- Norge and Pond Creek soils which are on the lower landscapes of high stream terraces
- Grainola soils which do not have a mollic epipedon and have more than 35 percent clay in the textural control section; on landscapes similar to those of the Kingfisher soils
- Lucien soils which do not have a Bt horizon and are less than 20 inches thick over sandstone; on adjacent landscapes, typically in the more sloping areas
- Ironmound soils which do not have a Bt horizon, are less than 20 inches thick over sandstone, and do not have a mollic epipedon; on adjacent landscapes, typically in the more sloping areas
- Nash soils which do not have a Bt2 horizon and contain less than 18 percent clay in the control section; on nearby landscapes
- Piedmont and Renthin soils which have more than 35 percent clay in the textural control section; on adjacent landscapes, typically in the more sloping areas

Typical Pedon

Kingfisher silt loam; Kingfisher County, Oklahoma; in a cultivated area, about 1 mile west and 5 miles south of Kingfisher, 1,800 feet west and 50 feet south of the northeast corner of sec. 16, T. 15 N., R. 7 W. (Colors are for dry soil unless otherwise stated.)

- Ap—0 to 14 inches; reddish brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; slightly hard, friable; many fine roots; upper 6 inches of horizon mixed by cultivation; many fine pores; slightly acid; gradual smooth boundary. (8 to 16 inches thick)
- BA—14 to 21 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate coarse granular structure; hard, friable; many fine roots; neutral; gradual smooth boundary. (3 to 10 inches thick)
- Bt1—21 to 32 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; hard, firm; common fine roots throughout peds; distinct continuous clay films on faces of peds; slightly alkaline; gradual smooth boundary. (6 to 16 inches thick)
- Bt2—32 to 38 inches; reddish brown (2.5YR 4/4) silty clay loam, dark reddish brown (2.5YR 3/4) moist; moderate medium subangular blocky structure; hard, firm; few fine pores; few fine roots; distinct continuous clay films on faces of peds; moderately alkaline; gradual wavy boundary. (2 to 10 inches thick)
- Cr—38 to 46 inches; red (2.5YR 5/8) weathered silty shale red beds, red (2.5YR 4/8) moist; weakly effervescent.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 16 inches

Thickness of the solum: 20 to 40 inches

Depth to bedrock: 20 to 40 inches

Ap horizon:

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3

Texture—loam or silt loam

Soil Survey of Canadian County, Oklahoma

Reaction—slightly acid to slightly alkaline
Clay content—15 to 27 percent

BA horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 4
Texture—silt loam, silty clay loam, or clay loam
Reaction—slightly acid to slightly alkaline
Clay content—25 to 35 percent

Bt1 horizon:

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6
Texture—silty clay loam or clay loam
Reaction—slightly acid to moderately alkaline
Clay content—27 to 35 percent

Bt2 horizon:

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6
Texture—silty clay loam, clay loam, or silty clay
Reaction—slightly acid to moderately alkaline
Clay content—27 to 40 percent

BC horizon (if it occurs):

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6
Texture—silty clay loam, clay loam, or silty clay
Reaction—neutral to moderately alkaline
Clay content—27 to 40 percent

Cr horizon:

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 8
Texture—weathered interbedded siltstone, shale, and sandstone that is paralithic
Excavation difficulty—high
Reaction—slightly alkaline or moderately alkaline

Kirkland Series

Major land resource area: Central Rolling Red Prairies (80A) (fig. 14)

Depth class: Very deep

Drainage class: Well drained

Parent material and geologic age: Material weathered from predominantly clayey mantles over shale of Permian age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Terrace

Landform position: Tread

Slope range: 0 to 3 percent

Slope shape: Linear-linear/concave

Elevation range: 190 to 220 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 58 to 64 degrees F

Thorntwaite PE index: 44 to 64

Taxonomic class: Fine, mixed, superactive, thermic Udertic Paleustolls

Associated Soils

- Renfrow soils which are on side slopes on the lower parts of the landscape



Figure 14.—Wheat on Kirkland silt loam, 0 to 1 percent slopes.

- Aydelotte and Grainola soils which do not have a mollic epipedon; on side slopes on the lower parts of the landscape
- Bethany soils which are on the slightly higher parts of the landscape
- Pawhuska and Doolin soils which have a natric horizon; on nearby landscapes
- Pond Creek soils which are fine-silty; on high terraces
- Tabler soils which are on the same landscape as the Kirkland soils but in the slightly lower positions
- Waurika soils which are on nearby landscapes in the slightly concave areas
- Renthin and Piedmont soils which have a solum less than 60 inches thick; on side slopes on the lower parts of the landscape

Typical Pedon

Kirkland silt loam; Logan County, Oklahoma; in a cultivated area, about 4 miles south and 8 miles west of Guthrie, 1,000 feet north and 150 feet west of the southeast corner of sec. 36, T. 16 N., R. 4 W. (Colors are for dry soil unless otherwise stated.)

Ap—0 to 8 inches; dark grayish brown (10YR 4/2, exterior) and grayish brown (10YR 5/2, crushed) silt loam, very dark brown (10YR 2/2, exterior) and very dark grayish brown (10YR 3/2, crushed) moist; moderate medium subangular blocky structure parting to moderate fine granular; soft, very friable; common very fine and fine roots throughout; common very fine and fine vesicular and tubular pores; electrical conductivity of the saturation extract is less than 1 mmho/cm; SAR is less than 1; strongly acid; abrupt wavy boundary. (6 to 14 inches thick)

Bt1—8 to 19 inches; dark grayish brown (10YR 4/2, exterior) and dark grayish brown (10YR 4/2, crushed) silty clay, black (10YR 2/1, exterior) and very dark gray (10YR 3/1, crushed) moist; weak medium prismatic structure parting to strong medium subangular blocky; very hard, very firm; common very fine and fine roots throughout; common very fine and fine vesicular and tubular pores; few fine rounded iron-manganese concretions; 65 percent of volume has distinct discontinuous clay films in root channels and pores; electrical conductivity of the saturation extract is less than 1 mmho/cm; SAR is 2; neutral; gradual smooth boundary. (11 to 15 inches thick)

Bt2—19 to 28 inches; brown to dark brown (7.5YR 4/2, exterior) and (7.5YR 4/3,

- crushed) silty clay, dark brown (7.5YR 3/2, exterior) and (7.5YR 3/3, crushed) moist; weak medium and coarse prismatic structure parting to strong medium subangular blocky; extremely hard, extremely firm; common very fine and fine roots throughout; common very fine and fine vesicular and tubular pores; about 2 percent of volume is prominent continuous intersecting slickensides on faces of peds; electrical conductivity of the saturation extract is less than 1 mmho/cm; SAR is 4; slightly alkaline; clear smooth boundary. (6 to 20 inches thick)
- Btk—28 to 42 inches; brown (7.5YR 4/2, exterior) and (7.5YR 4/3, crushed) silty clay, dark brown (7.5YR 3/2, exterior) and (7.5YR 3/3, crushed) moist; weak medium and coarse prismatic structure parting to strong medium angular blocky; extremely hard, extremely firm; common very fine and fine roots throughout; common very fine and fine vesicular and tubular pores; few fine and medium irregular carbonate threads; few medium rounded carbonate concretions; few medium rounded iron-manganese concretions; common distinct discontinuous clay films on faces of peds; common prominent continuous intersecting slickensides; strongly effervescent; electrical conductivity of the saturation extract is 1 mmho/cm; SAR is 6; moderately alkaline; gradual wavy boundary. (10 to 20 inches thick)
- 2Bt1—42 to 51 inches; brown (7.5YR 4/4, exterior) and dark brown (7.5YR 3/4, crushed) silty clay, dark brown (7.5YR 3/4, exterior) and (7.5YR 3/4, crushed) moist; strong medium prismatic structure parting to strong medium angular blocky; extremely hard, extremely firm; few very fine and fine roots throughout; common very fine and fine vesicular and tubular pores; few fine and medium rounded iron-manganese concretions; common faint continuous clay films on faces of peds; common distinct continuous intersecting slickensides; strongly effervescent; electrical conductivity of the saturation extract is 1.5 mmhos/cm; SAR is 7; moderately alkaline; gradual wavy boundary. (0 to 16 inches thick)
- 2Btk—51 to 60 inches; reddish brown (2.5YR 4/4, exterior) and (2.5YR 4/4, crushed) silty clay, dark reddish brown (2.5YR 3/4, exterior) and (2.5YR 3/4, crushed) moist; moderate medium and coarse prismatic structure parting to strong medium angular blocky; very hard, very firm; common very fine and fine roots throughout; common very fine and fine vesicular and tubular pores; many fine and common medium distinct dark red (2.5YR 3/6) redoximorphic accumulations associated with root channels; few fine and medium rounded iron-manganese concretions; few coarse rounded iron-manganese concretions; few medium and coarse carbonate concretions; cracks between peds are filled with dark brown (7.5YR 3/3) silty clay loam; strongly effervescent; 1 percent quartzite pebbles; electrical conductivity of the saturation extract is 1.76 mmhos/cm; SAR is 8; moderately alkaline; gradual wavy boundary. (0 to 18 inches thick)
- 2Bt2—60 to 75 inches; red (2.5YR 4/6, exterior) and reddish brown (2.5YR 4/4, crushed) silty clay, dark reddish brown (2.5YR 3/6, exterior) and dark red (2.5YR 3/4, crushed) moist; moderate coarse prismatic structure parting to moderate medium and coarse subangular blocky; very hard, very firm; few very fine and fine roots throughout; common fine and common very fine vesicular and tubular pores; common fine and medium prominent gray (10YR 6/1) and very dark gray (10YR 3/1) redoximorphic depletions associated with root channels; cracks between peds filled with (7.5YR 3/3) silty clay loam from above; strongly effervescent; electrical conductivity of the saturation extract is 2.16 mmhos/cm; SAR is 8; slightly alkaline; diffuse wavy boundary. (0 to 15 inches thick)
- 2Bt3—75 to 82 inches; red (2.5YR 4/6, exterior) and reddish brown (2.5YR 4/4, crushed) silty clay, dark red (2.5YR 3/6, exterior) and dark reddish brown (2.5YR 3/4, crushed) moist; moderate coarse prismatic structure parting to moderate medium and coarse subangular blocky; very hard, very firm; common very fine roots throughout; common fine and very fine vesicular and tubular pores; few

medium prominent brown (7.5YR 5/3), common fine distinct reddish gray (5YR 5/2), and common fine prominent very dark grayish brown (10YR 3/2) redoximorphic accumulations and depletions associated with root channels; few fine irregular threads of calcium carbonate; strongly effervescent; electrical conductivity of the saturation extract is 2.12 mmhos/cm; SAR is 7; slightly alkaline; abrupt wavy boundary. (0 to 11 inches thick)

3Cr—82 to 98 inches; red (2.5YR 5/8, exterior) weakly cemented sandy siltstone, red (2.5YR 4/8, exterior) moist; very hard, very firm; very few very fine roots in cracks; very slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 17 to 25 inches

Thickness of the solum: More than 60 inches

Depth to carbonates: 25 to 50 inches

Depth to bedrock: More than 60 inches

Other features: Cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years; slickensides in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; a linear extensibility of 6.0 cm or more between the mineral soil surface and a depth of 100 cm

A horizon:

Color—hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3

Texture—silt loam, clay loam, or silty clay loam

Reaction—moderately acid to neutral

Clay content—13 to 35 percent

Electrical conductivity of the saturation extract—0 to 1 mmho/cm

Sodium adsorption ratio—1 to 4

Bt1 horizon:

Color—hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 or 3

Texture—clay or silty clay

Reaction—neutral or slightly alkaline

Clay content—40 to 60 percent

Electrical conductivity of the saturation extract—0 to 2 mmhos/cm

Sodium adsorption ratio—2 to 12

Bt2 horizon:

Color—hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 to 4

Texture—clay or silty clay

Reaction—neutral to moderately alkaline

Clay content—40 to 60 percent

Electrical conductivity of the saturation extract—0 to 2 mmhos/cm

Sodium adsorption ratio—2 to 12

Btk horizon:

Color—hue of 2.5YR to 10YR, value of 4 to 6, and chroma of 3 to 6

Texture—clay, silty clay, clay loam, or silty clay loam

Reaction—slightly alkaline or moderately alkaline; calcareous

Clay content—35 to 60 percent

Electrical conductivity of the saturation extract—2 to 4 mmhos/cm

Sodium adsorption ratio—3 to 16

2Bt horizon:

Color—hue of 2.5YR to 10YR, value of 4 to 6, and chroma of 2 to 8

Texture—clay, silty clay, clay loam, or silty clay loam

Reaction—slightly alkaline or moderately alkaline; calcareous

Clay content—35 to 60 percent

Electrical conductivity of the saturation extract—2 to 4 mmhos/cm

Sodium adsorption ratio—3 to 16

Redoximorphic features—common concentrations in shades of red or brown and depletions in shades of gray

3Cr horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 to 8, and chroma of 2 to 8

Texture—weakly consolidated shale, clay, or siltstone

Excavation difficulty—low or moderate

Reaction—moderately alkaline; calcareous

Konawa Series

Major land resource area: Northern Cross Timbers (84A)

Depth class: Very deep

Drainage class: Well drained

Parent material and geologic age: Sandy and loamy stream terrace sediments of Pleistocene age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Terrace

Landform position: Tread and riser

Slope range: 0 to 20 percent

Slope shape: Linear/convex-convex

Elevation range: 500 to 1,500 feet

Mean annual precipitation: 30 to 40 inches

Mean annual air temperature: 58 to 64 degrees F

Frost-free days: 200 to 230

Thorntwaite PE index: 48 to 64

Taxonomic class: Fine-loamy, mixed, active, thermic Ultic Haplustalfs

Associated Soils

- Dougherty and Stidham soils which typically are in landform positions similar to those of the Konowa soils but, in some places, are in the slightly higher areas
- Bastrop soils which have a thicker argillic horizon that does not decrease in clay content with increasing depth; on broad flat landscapes that are slightly higher and farther from the stream channel than the Konowa soils
- Eufaula soils which have A horizons more than 20 inches thick and have a sandy control section; on the slightly higher landscapes
- Teller soils which have a mollic epipedon; typically in landform positions farther from the stream channel than the Konowa soils

Typical Pedon

Konawa fine sandy loam; Payne County, Oklahoma; in bermudagrass pasture, about 8 miles west and 1 mile south of Perkins, 2,000 feet north and 200 feet west of the southeast corner of sec. 10, T. 17 N., R. 1 E. (Colors are for dry soil unless otherwise stated.)

A—0 to 9 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary. (4 to 10 inches thick)

E—9 to 17 inches; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR

- 4/4) moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary. (0 to 17 inches thick)
- Bt—17 to 53 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate medium subangular blocky structure; very hard, friable; thin discontinuous clay films on peds; moderately acid; gradual smooth boundary. (10 to 36 inches thick)
- BC—53 to 72 inches; red (2.5YR 5/6) fine sandy loam, red (5YR 4/6) moist; weak coarse subangular blocky structure; very hard, friable; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 20 inches

Thickness of the solum: 40 to 60 inches

Depth to carbonates: 10 to 30 inches

A horizon:

Color—hue of 5YR to 10YR, value of 4 to 7, and chroma of 2 to 6

Texture—fine sandy loam, loamy fine sand, or fine sand

Reaction—strongly acid to slightly acid

Clay content—2 to 18 percent

E horizon:

Color—hue of 5YR to 10YR, value of 5 to 8, and chroma of 2 to 6

Texture—fine sandy loam, loamy fine sand, or fine sand

Reaction—strongly acid to slightly acid

Clay content—2 to 18 percent

Bt horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 4 to 8

Texture—fine sandy loam or sandy clay loam

Reaction—strongly acid to neutral

Clay content—18 to 30 percent

Content and size of coarse fragments—0 to 5 percent, by volume, rounded gravel
2 to 10 mm in diameter

BC horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 4 to 8

Texture—fine sandy loam, sandy clay loam, or loamy fine sand

Reaction—strongly acid to neutral

Clay content—7 to 30 percent

C horizon (if it occurs):

Color—hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 4 to 8

Texture—fine sandy loam, loamy fine sand, or fine sand

Reaction—strongly acid to slightly alkaline

Clay content—7 to 30 percent

Lovedale Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Well drained

Parent material and geologic age: Loamy sediments of Pleistocene age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Valley

Soil Survey of Canadian County, Oklahoma

Landform: Terrace

Landform position: Tread and riser

Slope range: 0 to 15 percent

Slope shape: Linear-linear/convex

Elevation range: 1,000 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 62 degrees F

Frost-free days: 190 to 220

Thorntwaite PE index: 44 to 64

Taxonomic class: Fine-loamy, mixed, superactive, thermic Udic Argiustolls

Associated Soils

- Waynoka and Wisby soils which are in the slightly lower positions
- Devol and Eda soils which have subsoil with less clay than the Lovedale soils; on the steeper slopes
- Milan soils which have more clay in the argillic horizon than the Lovedale soils; on the less sloping landscapes

Typical Pedon

Lovedale fine sandy loam; Woods County, Oklahoma; about 0.75 mile north of Dacoma, 180 feet north and 360 feet east of the southwest corner of sec. 1, T. 25 N., R. 13 W. (Colors are for dry soil unless otherwise stated.)

Ap—0 to 9 inches; brown (7.5YR 4/3) fine sandy loam, brown (7.5YR 3/3) moist; weak fine granular structure; hard, friable; common fine roots; moderately acid; clear smooth boundary.

BA—9 to 16 inches; dark brown (7.5YR 4/3) sandy clay loam, brown (7.5YR 3/3) moist; moderate medium subangular blocky structure; very hard, firm; common fine roots; few faint clay films on faces of peds; noneffervescent; slightly acid; gradual smooth boundary.

Bt1—16 to 26 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm; few fine roots; many distinct clay films on faces of peds; noneffervescent; neutral; clear smooth boundary.

Bt2—26 to 40 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate medium prismatic structure parting to weak coarse subangular blocky; very hard, firm; few fine roots; common distinct clay films on faces of peds; common fine rounded iron-manganese concretions; noneffervescent; moderately alkaline; clear smooth boundary.

BC—40 to 55 inches; reddish yellow (5YR 6/6) sandy loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure; hard, friable; noneffervescent; 1 percent gravel; moderately alkaline; abrupt smooth boundary.

C—55 to 80 inches; reddish yellow (5YR 7/6) fine sand, reddish yellow (5YR 6/6) moist; massive; loose; very slightly effervescent; 1 percent gravel; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 20 inches

Thickness of the solum: 30 to more than 60 inches

Depth to bedrock: More than 60 inches

Depth to carbonates: More than 34 inches

Ap or A horizon:

Color—hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 or 3

Texture—sandy loam, fine sandy loam, loamy sand, or loamy fine sand

Soil Survey of Canadian County, Oklahoma

Content and size of coarse fragments—0 to 2 percent, by volume, fragments less than 76 mm in diameter

BA or AB horizon:

Color—hue of 5YR to 10YR, value of 3 or 5, and chroma of 2 or 3

Texture—sandy loam, fine sandy loam, loam, or sandy clay loam

Reaction—moderately acid to neutral

Bt horizon:

Color—hue of 2.5YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6

Texture—sandy clay loam, loam, or sandy loam

Reaction—slightly acid to moderately alkaline

Clay content—18 to 27 percent; more than 20 percent sand coarser than fine

Content and size of coarse fragments—0 to 10 percent, by volume, fragments less than 76 mm in diameter

Redoximorphic features—concentrations in shades of yellow or brown below a depth of 40 inches

BC horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 to 6

Texture—sandy clay loam, sandy loam, or fine sandy loam

Reaction—neutral to moderately alkaline

Clay content—8 to 27 percent

Content and size of coarse fragments—0 to 10 percent, by volume, fragments less than 76 mm in diameter

C horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 to 7, and chroma of 4 to 8

Texture—coarse sandy loam, sandy loam, fine sandy loam, loamy sand, or sand

Reaction—slightly acid to moderately alkaline

Content and size of coarse fragments—0 to 20 percent, by volume, fragments 2 to 76 mm in diameter

McLain Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Moderately well drained

Parent material and geologic age: Clayey and loamy alluvium of Pleistocene age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Valley

Landform: High flood plain

Slope range: 0 to 1 percent

Slope shape: Linear-linear

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 58 to 64 degrees F

Frost-free days: 200 to 230

Thorntwaite PE index: 40 to 64

Taxonomic class: Fine, mixed, superactive, thermic Pachic Argiustolls

Associated Soils

- Brewer soils which do not have upper Bt horizons with hues of 5YR or redder; on the same flood plains as the McLain soils

Soil Survey of Canadian County, Oklahoma

- Canadian, Dale, and Reinach soils which have less than 35 percent clay in the control section and do not have Bt horizons; on the same flood plains as the McLain soils
- Lela soils which do not have Bt horizons; on the same flood plains as the McLain soils
- Miller soils which do not have Bt horizons; on the adjacent lower flood plains
- Port soils which have less than 35 percent clay in the control section and do not have Bt horizons; on the adjacent lower flood plains

Typical Pedon

McLain silty clay loam; Caddo County, Oklahoma; in a cultivated area, about 1 mile west of Verden, 1,000 feet south and 50 feet east of the northwest corner of sec. 13, T. 7 N., R. 9 W. (Colors are for dry soil unless otherwise stated.)

- A—7 to 14 inches; dark reddish gray (5YR 4/2) silty clay loam, dark reddish brown (5YR 2/2) moist; moderate medium granular structure; very hard, firm; neutral; gradual smooth boundary. (6 to 22 inches thick)
- Bt1—14 to 28 inches; reddish brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) moist; weak fine blocky structure; very hard, very firm; nearly continuous clay films on faces of pedis; slightly alkaline; gradual smooth boundary. (10 to 30 inches thick)
- Bt2—28 to 36 inches; reddish brown (2.5YR 5/4) silty clay loam, reddish brown (2.5YR 4/4) moist; weak medium subangular blocky structure; very hard, firm; patchy clay films on faces of pedis; slightly alkaline; gradual smooth boundary. (0 to 20 inches thick)
- C—36 to 60 inches; reddish brown (2.5YR 5/4) silty clay loam, reddish brown (2.5YR 4/4) moist; massive; hard, friable; few soft powdery accumulations and few fine concretions of calcium carbonate; calcareous; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: More than 20 inches

Thickness of the solum: 30 to more than 60 inches

Depth to carbonates: 30 inches or more

A horizon:

Color—hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 or 3

Texture—silty clay loam, silt loam, loam, or clay loam

Reaction—moderately acid to moderately alkaline

Clay content—18 to 35 percent

BA horizon (if it occurs):

Color—hue of 5YR to 10YR, value of 3 to 5, and chroma of 2 or 3

Texture—silty clay loam, silt loam, loam, or clay loam

Reaction—moderately acid to moderately alkaline

Clay content—18 to 35 percent

Bt1 horizon:

Color—hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 2 to 8

Texture—silty clay loam, clay loam, silty clay, or clay

Reaction—slightly acid to moderately alkaline

Clay content—35 to 50 percent

Bt2 horizon:

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6

Texture—silty clay loam, clay loam, silty clay, or clay

Reaction—slightly acid to moderately alkaline

Clay content—35 to 50 percent

BC horizon (if it occurs):

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6

Texture—silty clay loam, clay loam, silty clay, or clay

Reaction—slightly acid to moderately alkaline

Clay content—35 to 50 percent

C horizon:

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 3 to 8

Texture—silt loam, loam, silty clay loam, clay loam, silty clay, or clay

Reaction—neutral to moderately alkaline

Clay content—20 to 45 percent

Minco Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Well drained

Parent material and geologic age: Loamy eolian deposits of Pleistocene age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Terrace

Landform position: Tread and riser

Slope range: 0 to 30 percent

Slope shape: Linear/convex-convex

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 58 to 64 degrees F

Frost-free days: 200 to 230

Thorntwaite PE index: 44 to 64

Taxonomic class: Coarse-silty, mixed, superactive, thermic Udic Haplustolls

Associated Soils

- Grant, Norge, and Teller soils which have an argillic horizon with a clay content of more than 18 percent; in the higher positions
- Pond Creek soils which have a mollic epipedon more than 20 inches thick and an argillic horizon with a clay content of more than 18 percent; in the higher positions
- Dougherty and Konawa soils which have an argillic horizon but do not have a mollic epipedon; in positions similar to or slightly higher than those of the Minco soils
- Reinach soils which have a mollic epipedon more than 20 inches thick; on low terraces of flood plains

Typical Pedon

Minco silt loam; Grady County, Oklahoma; in a cultivated area, about 1 ³/₄ miles north of Tuttle, 1,035 feet south and 300 feet east of the northwest corner of sec. 26, T. 10 N., R. 6 W. (Colors are for dry soil unless otherwise stated.)

Ap—0 to 7 inches; dark brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; weak medium granular structure; slightly hard, very friable; many fine roots; moderately acid; abrupt smooth boundary. (0 to 10 inches thick)

A—7 to 15 inches; dark brown (7.5YR 4/3) silt loam, dark brown (7.5YR 3/3) moist; moderate medium granular structure; slightly hard, very friable; many fine roots; slightly acid; gradual smooth boundary. (6 to 12 inches thick)

Bw1—15 to 24 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4)

- moist; moderate medium prismatic structure; slightly hard, friable; common fine roots; slightly alkaline; gradual smooth boundary. (8 to 14 inches thick)
- Bw2—24 to 38 inches; light reddish brown (5YR 6/4) silt loam, reddish brown (5YR 5/4) moist; moderate medium prismatic structure; slightly hard, friable; common fine roots; slightly alkaline; gradual smooth boundary. (10 to 20 inches thick)
- Bw3—38 to 55 inches; red (2.5YR 5/6) silt loam, red (2.5YR 4/6) moist; weak coarse prismatic structure; slightly hard, friable; few fine roots; moderately alkaline; gradual smooth boundary. (0 to 20 inches thick)
- C—55 to 72 inches; red (2.5YR 5/8) silt loam, red (2.5YR 4/8) moist; massive; slightly hard, friable; few fine roots; few films of secondary carbonates; calcareous; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 20 inches

Thickness of the solum: 25 to more than 60 inches

Depth to bedrock: More than 72 inches

A horizon:

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3

Texture—loam, silt loam, or very fine sandy loam

Reaction—moderately acid to neutral

Clay content—8 to 18 percent

Bw horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 3 to 6

Texture—loam, silt loam, or very fine sandy loam

Reaction—slightly acid to moderately alkaline

Clay content—8 to 18 percent

BC horizon (if it occurs):

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8

Texture—loam, silt loam, or very fine sandy loam

Reaction—slightly acid to moderately alkaline

Clay content—8 to 18 percent

C horizon (if it occurs):

Color—hue of 2.5YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8

Texture—typically loam, silt loam, or very fine sandy loam; fine sandy loam occurs below a depth of 40 inches in some pedons

Reaction—slightly acid to moderately alkaline

Clay content—8 to 18 percent

Nash Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Moderately deep

Drainage class: Well drained

Parent material and geologic age: Sandstone of Permian age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Hill

Landform position: Summit and backslope

Slope range: 0 to 20 percent

Slope shape: Linear/convex-convex

Soil Survey of Canadian County, Oklahoma

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 28 to 40 inches

Mean annual air temperature: 57 to 65 degrees F

Frost-free days: 200 to 230

Thorntwaite PE index: 44 to 64

Taxonomic class: Coarse-silty, mixed, superactive, thermic Udic Haplustolls

Associated Soils

- Chickasha and Zaneis soils which have an argillic horizon and have a fine-loamy control section; typically on broad ridges on flats
- Grant and Pond Creek soils which have a fine-silty control section and have an argillic horizon; typically on broad ridges on flats
- Lucien soils which are typically on the slightly higher convex ridges
- Ironmound soils which have a solum less than 20 inches thick and do not have a mollic epipedon; typically on the slightly higher convex ridges

Typical Pedon

Nash silt loam; Garfield County, Oklahoma; in a cultivated area, about 1 mile south and 3 1/2 miles east of Hillsdale, 1,000 feet east and 500 feet south of the northwest corner of sec. 23, T. 24 N., R. 7 W. (Colors are for dry soil unless otherwise stated.)

Ap—0 to 6 inches; reddish brown (5YR 5/3) silt loam, dark reddish brown (5YR 3/3) moist; weak fine granular structure; slightly hard, friable; common fine roots; slightly acid; clear smooth boundary. (0 to 8 inches thick)

A—6 to 10 inches; reddish brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate fine granular structure; slightly hard, friable; common fine roots; slightly acid; gradual smooth boundary. (4 to 15 inches thick)

Bw—10 to 22 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to moderate fine granular; slightly hard, friable; few fine roots; neutral; gradual smooth boundary. (10 to 25 inches thick)

BC—22 to 30 inches; red (2.5YR 5/6) silt loam, red (2.5YR 4/6) moist; weak coarse prismatic structure; slightly hard, friable; few fine roots; about 5 percent, by volume, coarse sandstone fragments less than 3 inches in diameter; slightly alkaline; clear smooth boundary. (0 to 12 inches thick)

Cr—30 to 40 inches; red (2.5YR 5/6) weakly consolidated calcareous sandstone, red (2.5YR 4/6) moist.

Range in Characteristics

Thickness of the mollic epipedon: 4 to 15 inches

Thickness of the solum: 20 to 40 inches

Depth to bedrock: 20 to 40 inches

Ap or A horizon:

Color—hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 or 3

Texture—silt loam, loam, very fine sandy loam, or fine sandy loam

Reaction—slightly acid to moderately alkaline

Clay content—10 to 18 percent

Bw horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 3 to 6

Texture—silt loam, loam, very fine sandy loam, or fine sandy loam

Reaction—slightly acid to moderately alkaline

Clay content—10 to 18 percent

BC horizon:

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 6 to 8

Texture—silt loam, loam, very fine sandy loam, or fine sandy loam

Reaction—slightly acid to moderately alkaline

Clay content—10 to 18 percent

Cr horizon:

Color—hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 6 to 8

Texture—weakly consolidated sandstone

Reaction—slightly alkaline or moderately alkaline; calcareous or noncalcareous

Noble Series

Major land resource area: Northern Cross Timbers (84A)

Depth class: Very deep

Drainage class: Well drained

Parent material and geologic age: Colluvium and alluvium weathered from sandstone of Permian age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Hill

Landform position: Footslope and toeslope

Slope range: 1 to 30 percent

Slope shape: Convex-convex

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 30 to 40 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free days: 190 to 220

Thorntwaite PE index: 44 to 64

Taxonomic class: Coarse-loamy, siliceous, active, thermic Udic Haplustepts

Associated Soils

- Teller soils which have a mollic epipedon, mixed mineralogy, and a fine-loamy control section; on the lower stream terraces
- Darnell soils which have sandstone bedrock at a depth of 10 to 20 inches; in the higher positions
- Harrah, Littleaxe, and Stephenville soils which have a fine-loamy control section; in the higher positions
- Newalla soils which have a fine-loamy over clayey control section; in the higher positions
- Zaneis soils which have a mollic epipedon, have mixed mineralogy, and have a fine-loamy control section; in the higher positions

Typical Pedon

Noble fine sandy loam; Caddo County, Oklahoma; in a cultivated area, about 1 mile north and 6 miles east of Gracemont, 1,500 feet east and 900 feet south of the northwest corner of sec. 4, T. 8 N., R. 9 W. (Colors are for dry soil unless otherwise stated.)

Ap—0 to 7 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; many fine roots; slightly acid; clear smooth boundary. (4 to 20 inches thick)

Bw—7 to 28 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine and medium granular structure; slightly hard, very friable;

- common fine roots; many fine pores; slightly acid; gradual smooth boundary. (10 to 40 inches thick)
- C—28 to 72 inches; red (2.5YR 4/6) fine sandy loam, dark red (2.5YR 3/6) moist; massive; slightly hard, very friable; common fine roots; many fine pores; slightly acid.

Range in Characteristics

Thickness of the ochric epipedon: 10 to 20 inches

Thickness of the solum: 20 to 60 inches

Depth to bedrock: More than 60 inches

A horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 4

Texture—loam, very fine sandy loam, or fine sandy loam

Reaction—neutral to moderately acid

Clay content—10 to 18 percent

Bw horizon:

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6

Texture—fine sandy loam, very fine sandy loam, or loam

Reaction—neutral to moderately acid

Clay content—10 to 18 percent

C horizon:

Color—hue of 10R to 5YR, value of 6, and chroma of 4 to 8

Texture—fine sandy loam, very fine sandy loam, or loam

Reaction—neutral to moderately acid

Clay content—10 to 18 percent

Norge Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Well drained

Parent material and geologic age: Loamy alluvium of Pleistocene age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Terrace

Landform position: Tread and riser

Slope range: 0 to 8 percent

Slope shape: Linear-linear/convex

Elevation range: 900 to 1,300 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 58 to 64 degrees F

Frost-free days: 200 to 230

Thorntwaite PE index: 44 to 64

Taxonomic class: Fine-silty, mixed, active, thermic Udic Paleustolls

Associated Soils

- Bethany soils which have a fine control section; on the same or higher landscapes as the Norge soils
- Grant soils which have a solum less than 60 inches thick and have a decrease in

clay content by more than 20 percent within a depth of 60 inches; on side slopes of nearby landscapes

- Navina, Teller, and Vanoss soils which have a decrease in clay content by more than 20 percent within a depth of 60 inches; on the lower terraces or on the same terrace as the Norge soils but nearer the stream
- Pond Creek soils which have a mollic epipedon more than 20 inches thick and have a decrease in clay content within a depth of 60 inches; on the lower terraces or on the same terrace as the Norge soils but nearer the stream

Typical Pedon

Norge silt loam; Pawnee County, Oklahoma; in a cultivated area, about 8 miles northeast of Pawnee, 725 feet east and 150 feet south of the northwest corner of sec. 9, T. 22 N., R. 6 E. (Colors are for dry soil unless otherwise stated.)

- A—0 to 12 inches; dark brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; moderately acid; gradual smooth boundary. (6 to 16 inches thick)
- BA—12 to 18 inches; reddish brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; hard, friable; many fine roots; moderately acid; gradual smooth boundary. (0 to 10 inches thick)
- Bt1—18 to 36 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; very hard, firm; common fine roots; nearly continuous clay films on faces of peds; moderately acid; gradual smooth boundary. (9 to 25 inches thick)
- Bt2—36 to 48 inches; red (2.5YR 5/6) silty clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; very hard, firm; common fine roots; continuous clay films on faces of peds; slightly acid; gradual smooth boundary. (9 to 37 inches thick)
- Bt3—48 to 66 inches; red (2.5YR 5/8) silty clay loam, red (2.5YR 4/8) moist; weak coarse subangular blocky structure; hard, firm; few fine roots; discontinuous clay films on faces of peds; slightly acid.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 20 inches

Thickness of the solum: More than 60 inches

Depth to carbonates: More than 40 inches

A horizon:

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3

Texture—silt loam, loam, silty clay loam, or clay loam

Reaction—moderately acid to neutral

Clay content—15 to 35 percent

BA horizon:

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 to 4

Texture—silt loam, loam, silty clay loam, or clay loam

Reaction—moderately acid to neutral

Clay content—18 to 35 percent

Bt1 horizon:

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6

Texture—silty clay loam or clay loam

Reaction—moderately acid to slightly alkaline

Clay content—27 to 35 percent

Bt2 horizon:

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6

Texture—silty clay loam or clay loam
Reaction—moderately acid to slightly alkaline
Clay content—27 to 35 percent

Bt3 horizon:

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 8
Redoximorphic features—concentrations in shades of yellow or brown; depletions may occur in shades of gray
Texture—silty clay loam, silty clay, or clay loam
Reaction—slightly acid to moderately alkaline
Clay content—27 to 50 percent

Pawhuska Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Moderately well drained

Parent material and geologic age: Interbedded sandstones and shales of Permian age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Hill

Landform position: Summit and shoulder

Slope range: 0 to 5 percent

Slope shape: Linear-linear/convex

Elevation range: 700 to 1,500 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 58 to 64 degrees F

Frost-free days: 200 to 230

Thorntwaite PE index: 44 to 64

Taxonomic class: Fine, mixed, superactive, thermic Mollic Natrustalfs

Associated Soils

- Corbin, Kirkland, Norge, and Renfrow soils which do not have a natric horizon; on the same landscape as the Pawhuska soils

Typical Pedon

Pawhuska silt loam; Osage County, Oklahoma; in rangeland, about 2 miles south and 6 miles west of Burbank, 500 feet south and 380 feet west of the northeast corner of sec. 11, T. 25 N., R. 4 E. (Colors are for dry soil unless otherwise stated.)

A—0 to 3 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable; many fine roots; neutral; abrupt wavy boundary. (2 to 11 inches thick)

Btn1—3 to 10 inches; dark brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate medium columnar structure parting to strong fine blocky; very hard, firm; common fine roots; nearly continuous clay films on faces of peds; grayish coatings on tops of columns; slightly alkaline; clear smooth boundary. (6 to 17 inches thick)

Btn2—10 to 18 inches; reddish gray (5YR 5/2) silty clay, dark reddish gray (5YR 4/2) moist; moderate medium blocky structure; extremely hard, firm; few fine roots; nearly continuous clay films on faces of peds; many fine concretions of calcium carbonate; moderately alkaline; clear wavy boundary. (8 to 17 inches thick)

Btn3—18 to 30 inches; reddish brown (5YR 5/3) silty clay, reddish brown (5YR 4/3) moist; moderate medium blocky structure; extremely hard, firm; few fine roots;

- nearly continuous clay films on faces of peds; few fine black concretions; many fine concretions of calcium carbonate; few fine soft accumulations of calcium carbonate; moderately alkaline; gradual smooth boundary. (0 to 20 inches thick)
- Btn4—30 to 50 inches; reddish brown (5YR 5/3) silty clay loam, reddish brown (5YR 4/3) moist; weak medium blocky structure; extremely hard, firm; few fine roots; patchy clay films on faces of peds; common fine black concretions; common fine concretions of calcium carbonate; few fine soft accumulations of calcium carbonate; slight effervescence; moderately alkaline; gradual smooth boundary. (0 to 20 inches thick)
- BC—50 to 80 inches; reddish brown (5YR 5/3) silty clay loam, reddish brown (5YR 4/3) moist; weak medium and coarse blocky structure; extremely hard, firm; patchy clay films on faces of peds; common fine black concretions; few fine concretions of calcium carbonate; few fine soft accumulations of calcium carbonate; slight effervescence; moderately alkaline.

Range in Characteristics

Thickness of the umbric epipedon: 2 to 11 inches

Thickness of the solum: More than 60 inches

Depth to carbonates: 10 to 35 inches

Depth to bedrock: More than 60 inches

A or Ap horizon:

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 1 to 4

Texture—silt loam or silty clay loam

Reaction—moderately acid to neutral

Clay content—18 to 35 percent

Electrical conductivity of the saturation extract—2 to 16 mmhos/cm

Sodium adsorption ratio—5 to 20

E horizon (if it occurs):

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 to 6

Texture—silt loam or silty clay loam

Reaction—moderately acid to neutral

Clay content—18 to 35 percent

Electrical conductivity of the saturation extract—2 to 16 mmhos/cm

Sodium adsorption ratio—5 to 20

Btn1 horizon:

Color—hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 1 to 4

Texture—clay, silty clay loam, or silty clay

Reaction—slightly acid to moderately alkaline

Clay content—35 to 50 percent

Electrical conductivity of the saturation extract—2 to 16 mmhos/cm

Sodium adsorption ratio—15 to 26

Btn2 horizon:

Color—hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 2 to 8

Texture—silty clay loam or silty clay

Reaction—neutral to moderately alkaline

Clay content—35 to 50 percent

Electrical conductivity of the saturation extract—2 to 16 mmhos/cm

Sodium adsorption ratio—16 to 25

Btn3 horizon:

Color—hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 2 to 8

Texture—silty clay loam or silty clay

Reaction—neutral to moderately alkaline

Clay content—35 to 50 percent

Electrical conductivity of the saturation extract—2 to 16 mmhos/cm

Sodium adsorption ratio—16 to 25

Btn4 horizon:

Color—hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 2 to 8

Texture—silty clay loam or silty clay

Reaction—neutral to moderately alkaline

Clay content—35 to 50 percent

Electrical conductivity of the saturation extract—2 to 16 mmhos/cm

Sodium adsorption ratio—16 to 25

BC horizon:

Color—hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6

Texture—silty clay loam or silty clay

Reaction—slightly alkaline or moderately alkaline

Clay content—35 to 50 percent

Electrical conductivity of the saturation extract—2 to 16 mmhos/cm

Sodium adsorption ratio—16 to 25

Pond Creek Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Well drained

Parent material and geologic age: Alluvium or loess of Pleistocene age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Stream terrace

Landform position: Tread

Slope range: 0 to 6 percent

Slope shape: Linear-linear/convex

Elevation range: 750 to 1,500 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 59 to 64 degrees F

Frost-free days: 190 to 230

Thornthwaite PE index: 44 to 58

Taxonomic class: Fine-silty, mixed, superactive, thermic Pachic Argiustolls

Associated Soils

- Bethany and Tabler soils which have more than 35 percent clay in the textural control section
- Wetbeth soils which have more than 35 percent clay in the textural control section and have redoximorphic features in the argillic horizon
- Grant, Milan, and Nash soils which have a mollic epipedon less than 20 inches thick

Typical Pedon

Pond Creek silt loam; Garfield County, Oklahoma; about 1/2 mile north of Carrier, 300 feet south of the northeast corner of SE 1/4, sec. 11, T. 23 N., R. 8 W. (Colors are for dry soil unless otherwise stated.)

- Ap—0 to 6 inches; dark brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.
- A—6 to 12 inches; dark brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate medium granular structure; slightly hard, friable; neutral; gradual smooth boundary.
- BA—12 to 22 inches; reddish brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; weak medium subangular blocky structure parting to moderate medium granular; hard, friable; neutral; gradual smooth boundary.
- Bt1—22 to 30 inches; reddish brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky structure; hard, firm; clay films on faces of peds; neutral; gradual smooth boundary.
- Bt2—30 to 46 inches; reddish brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; strong medium subangular blocky structure; hard, firm; clay films on faces of peds; neutral; gradual smooth boundary.
- BC—46 to 60 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; hard, firm; neutral; gradual smooth boundary.
- C—60 to 80 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; massive; hard, firm; few small lime concretions; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: More than 20 inches

Thickness of the solum: 40 to more than 60 inches

Depth to carbonates: 40 to more than 60 inches

A horizon:

Color—hue of 5YR to 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3

Texture—silt loam, loam, or fine sandy loam

Reaction—moderately acid to slightly alkaline

BA horizon:

Color—hue of 5YR to 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3

Texture—loam, silt loam, clay loam, or silty clay loam

Reaction—slightly acid to moderately alkaline

Clay content—20 to 32 percent

Bt horizon:

Color—hue of 5YR to 10YR, value of 4 or 5 (3 or 4 moist), and chroma of 2 to 4

Texture—loam, silt loam, clay loam, or silty clay loam

Reaction—slightly acid to moderately alkaline; horizon may be calcareous in the lower part

Clay content—24 to 35 percent in the upper part of horizon; content can range to as much as 40 percent in the lower part

BC horizon:

Color—hue of 2.5YR to 10YR, value of 4 or 5 (3 or 4 moist), and chroma of 3 to 6

Texture—loam, silt loam, clay loam, or silty clay loam

Reaction—neutral to moderately alkaline; horizon may be calcareous

Clay content—20 to 40 percent

C horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 to 6 (3 to 5 moist), and chroma of 3 to 8

Texture—loam, silt loam, clay loam, or silty clay loam

Reaction—neutral to moderately alkaline in the upper part of horizon and slightly alkaline or moderately alkaline in the lower part; typically calcareous

Port Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Well drained

Parent material and geologic age: Calcareous loamy alluvium of Recent age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Valley

Landform: Low flood plain

Slope range: 0 to 3 percent

Slope shape: Linear-linear

Elevation range: 700 to 1,300 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 58 to 64 degrees F

Frost-free days: 185 to 220

Thorntwaite PE index: 44 to 64

Taxonomic class: Fine-silty, mixed, superactive, thermic Cumulic Haplustolls

Associated Soils

- Ashport and Easpor soils which have a mollic epipedon less than 20 inches thick; on the slightly lower flood plains but closer to the stream
- Dale, Lawrie, and Reinach soils which are on the slightly higher flood plains
- Brewer and McLain soils which have a fine control section and have an argillic horizon
- Lawrie soils which have an argillic horizon; on the slightly higher flood plains
- Canadian soils which have a mollic epipedon less than 20 inches thick and have a coarse-loamy control section; on the slightly higher flood plains
- Gaddy soils which have a sandy control section and do not have a mollic epipedon; typically on the slightly lower flood plains closer to the stream channel
- Miller soils which have a fine control section; in landform positions similar to those of the Port soils
- Pulaski and Yahola soils which have a coarse-loamy control section and do not have a mollic epipedon; in landform positions similar to those of the Port soils

Typical Pedon

Port silt loam; Grady County, Oklahoma; in a cultivated area, about 7 miles east of Chickasha, 2,300 feet north and 100 feet east of the southwest corner of sec. 24, T. 7 N., R. 6 W. (Colors are for dry soil unless otherwise stated.)

Ap—0 to 9 inches; reddish brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; soft, very friable; neutral; clear smooth boundary. (0 to 11 inches thick)

A—9 to 27 inches; dark reddish brown (5YR 3/3) silt loam, dark reddish brown (5YR 2/2) moist; moderate coarse granular structure; slightly hard, friable; neutral; gradual smooth boundary. (10 to 30 inches thick)

Bw—27 to 42 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; hard, firm; few thin strata of darker material; common soft masses and films of secondary lime; calcareous; moderately alkaline; diffuse smooth boundary. (0 to 25 inches thick)

C—42 to 72 inches; reddish brown (2.5YR 5/4) silt loam, reddish brown (2.5YR 4/4) moist; massive; hard, firm; few thin strata of dark reddish brown silty clay loam; common soft masses and films of secondary lime; calcareous; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 20 to 40 inches

Depth to carbonates: 20 to 60 inches

Ap or A horizon:

Color—hue of 2.5YR to 10YR, value of 3 to 5, and chroma of 1 to 3

Texture—loam, silt loam, clay loam, or silty clay loam

Reaction—moderately acid to slightly alkaline

Clay content—10 to 35 percent

Bw horizon:

Color—hue of 2.5YR to 7.5YR, value of 3 to 6, and chroma of 1 to 6

Texture—loam, silt loam, clay loam, or silty clay loam

Reaction—slightly acid to moderately alkaline

Clay content—20 to 35 percent

C horizon:

Color—hue of 2.5YR to 7.5YR, value of 3 to 6, and chroma of 1 to 6

Texture—loam, silt loam, clay loam, or silty clay loam

Reaction—moderately alkaline; calcareous

Clay content—20 to 35 percent

Reinach Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Well drained

Parent material and geologic age: Loamy alluvium of Pleistocene age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Valley

Landform: High flood plain

Slope range: 0 to 1 percent

Slope shape: Linear-linear

Elevation range: 700 to 1,300 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free days: 190 to 230

Thorntwaite PE index: 44 to 64

Taxonomic class: Coarse-silty, mixed, superactive, thermic Pachic Haplustolls

Associated Soils

- Amber soils which do not have a mollic epipedon; in the slightly lower areas
- Canadian and Crisfield soils which are on the same landscape as the Reinach soils but closer to the streams
- Dale soils which are on the same landscape as the Reinach soils but further from the stream
- Hawley soils which have a coarse-loamy textural control section; on the same landscape as the Reinach soils but closer to the streams
- McLain soils which have an argillic horizon that has more than 35 percent clay in the control section; on high flood plains, but on the lower landscapes farther from the stream
- Port soils which have more than 18 percent clay in the textural control section; on the lower flood plains

- Yahola soils which do not have a mollic epipedon and have a coarse-loamy textural control section; on the lower flood plains

Typical Pedon

Reinach silt loam; Grady County, Oklahoma; about 1 mile north and 1.6 miles east of Verden, 2,060 feet west and 50 feet north of the southwest corner of sec. 6, T. 7 N., R. 8 W. (Colors are for dry soil unless otherwise stated.)

- Ap—0 to 9 inches; brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable; many fine roots; neutral; clear smooth boundary. (0 to 12 inches thick)
- A1—9 to 14 inches; reddish brown (5YR 5/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate fine granular structure; slightly hard, very friable; many fine pores; many wormcasts; neutral; gradual smooth boundary. (5 to 18 inches thick)
- A2—14 to 30 inches; reddish brown (2.5YR 5/3) silt loam, dark reddish brown (2.5YR 3/3) moist; weak fine and medium granular structure; slightly hard, very friable; many fine pores; many wormcasts; few dark krotovina; slightly alkaline; gradual smooth boundary. (8 to 24 inches thick)
- Bw—30 to 50 inches; red (2.5YR 5/6) silt loam, red (2.5YR 4/6) moist; weak fine and medium granular structure; slightly hard, very friable; many fine pores; many wormcasts; few dark krotovina; few soft bodies and threads of secondary lime beginning at a depth of 35 inches; calcareous; moderately alkaline; gradual smooth boundary. (6 to 40 inches thick)
- C—50 to 84 inches; red (2.5YR 5/6) very fine sandy loam, red (2.5YR 4/6) moist; massive; slightly hard, very friable; many fine roots and pores; few wormcasts; few soft bodies and films of secondary lime; few fine concretions of calcium carbonate; calcareous; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: More than 20 inches

Depth to carbonates: 20 to 60 inches

Depth to buried horizons: Buried A horizons are below a depth of 40 inches in some pedons

A horizon:

Color—hue of 2.5YR to 10YR, value of 4 or 5 (3 moist), and chroma of 2 or 3

Texture—loam, very fine sandy loam, or silt loam

Reaction—slightly acid to moderately alkaline

Bw horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 6

Texture—loam, very fine sandy loam, or silt loam

Reaction—neutral to moderately alkaline; typically calcareous

C horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 to 6 (3 to 5 moist), and chroma of 3 to 6

Texture—typically very fine sandy loam, loam, or silt loam; horizon is stratified with thin strata of coarser or finer textured materials below a depth of 50 inches in some pedons

Reaction—moderately alkaline; calcareous

Renfrow Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Well drained

Soil Survey of Canadian County, Oklahoma

Parent material and geologic age: Clayey shale of Permian age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Hill

Landform position: Summit and backslope

Slope range: 0 to 5 percent

Slope shape: Linear-linear/convex

Elevation range: 900 to 1,500 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 58 to 64 degrees F

Frost-free days: 190 to 230

Thorntwaite PE index: 44 to 64

Taxonomic class: Fine, mixed, superactive, thermic Udertic Paleustolls

Associated Soils

- Bethany and Kirkland soils which are on the higher parts of the landscape
- Tabler soils which have a mollic epipedon more than 20 inches thick; on the higher parts of the landscape
- Piedmont and Renthin soils which have a solum less than 60 inches thick; typically on shoulder slopes
- Grainola and Masham soils which do not have a mollic epipedon and have a solum that is less than 60 inches thick; typically on backslopes
- Kingfisher soils which have a fine-silty control section
- Stoneburg and Zaneis soils which have a fine-loamy control section; on the same landscape as the Renfrow soils

Typical Pedon

Renfrow silt loam; Kay County, Oklahoma; in native range, about 4 miles south and 3 miles west of Tonkawa, 2,200 feet south and 50 feet east of the northwest corner of sec. 25, T. 25 N., R. 2 W. (Colors are for dry soil unless otherwise stated.)

A—0 to 9 inches; brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate medium granular structure; hard, friable; many fine roots; slightly acid; gradual smooth boundary. (5 to 12 inches thick)

BA—9 to 13 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate medium subangular blocky structure; hard, friable; many fine roots; slightly acid; clear smooth boundary. (3 to 10 inches thick)

Btss1—13 to 25 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, very firm; nearly continuous clay films on faces of peds; few slickensides; common fine roots; neutral; gradual smooth boundary. (8 to 20 inches thick)

Btss2—25 to 40 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate coarse blocky structure; extremely hard, very firm; nearly continuous clay films on faces of peds; common slickensides; few fine roots; calcareous at a depth of 30 inches; slightly alkaline; gradual smooth boundary. (8 to 25 inches thick)

Btss3—40 to 65 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; weak coarse blocky structure; extremely hard, very firm; patchy clay films on faces of peds; few slickensides; few fine roots; few fine and medium concretions of calcium carbonate; few fine soft rounded bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary. (0 to 33 inches thick)

Bck—65 to 75 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; massive; extremely hard, very firm; calcareous; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 20 inches

Thickness of the solum: More than 60 inches

Depth to carbonates: 20 to 50 inches

Depth to bedrock: More than 80 inches

Other features: Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years; slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; a linear extensibility of 6.0 cm or more between the mineral soil surface and a depth of 100 cm

A horizon:

Color—hue of 5YR to 10YR, value of 4 or 5, and chroma of 2 or 3

Texture—silt loam, silty clay loam, clay loam, or loam

Reaction—moderately acid to slightly alkaline

Clay content—18 to 35 percent

BA horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 2 to 4

Texture—silty clay loam, clay loam, or silt loam

Reaction—slightly acid to slightly alkaline

Clay content—22 to 40 percent

Bt1 horizon:

Color—hue of 2.5YR to 5YR, value of 4 to 6, and chroma of 3 to 6

Texture—clay, silty clay, silty clay loam, or clay loam

Reaction—slightly acid to moderately alkaline

Clay content—35 to 55 percent

Bt2 horizon:

Color—hue of 2.5YR to 5YR, value of 4 to 6, and chroma of 3 to 6

Texture—clay, silty clay, silty clay loam, or clay loam

Reaction—slightly acid to moderately alkaline

Clay content—35 to 55 percent

Bt3 horizon:

Color—hue of 10R to 5YR, value of 4 to 6, and chroma of 3 to 8

Texture—clay, silty clay, silty clay loam, or clay loam

Reaction—neutral to moderately alkaline

Clay content—35 to 55 percent

BC horizon (if it occurs):

Color—hue of 10R to 5YR, value of 4 to 6, and chroma of 3 to 8

Texture—clay, silty clay, silty clay loam, or clay loam

Reaction—moderately alkaline; calcareous

Clay content—35 to 55 percent

Content and size of coarse fragments—0 to 15 percent, by volume, shale gravel 2 to 25 mm in diameter

C horizon (if it occurs):

Color—hue of 10R to 5YR, value of 4 to 6, and chroma of 6 to 8

Texture—clay, silty clay, silty clay loam, or clay loam

Reaction—moderately alkaline; calcareous

Clay content—35 to 55 percent

Content and size of coarse fragments—0 to 15 percent, by volume, shale gravel 2 to 25 mm in diameter

Redoximorphic features—redoximorphic concentrations in shades of red or brown in some pedons; depletions in shades of gray

Watonga Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Moderately well drained

Parent material and geologic age: Loamy and clayey alluvium of Pleistocene age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Valley

Landform: High flood plain

Slope range: 0 to 1 percent

Slope shape: Linear-linear/concave

Elevation range: 800 to 1,100 feet

Mean annual precipitation: 28 to 40 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free days: 200 to 230

Thorntwaite PE index: 44 to 64

Taxonomic class: Fine, smectitic, thermic Udic Haplusterts

Associated Soils

- Brewer and McLain soils which have an argillic horizon; in landform positions similar to those of the Watonga soils
- Canadian soils which have a coarse-loamy control section; in landform positions similar to those of the Watonga soils
- Dale soils which have a fine-silty control section; in landform positions similar to those of the Watonga soils
- Reinach soils which have a coarse-silty control section; in landform positions similar to those of the Watonga soils

Typical Pedon

Watonga silty clay; Canadian County, Oklahoma; in a cultivated field, in the center of a microhigh, about 1 mile south and 3 miles east of Yukon, 4,500 feet east and 50 feet north of the southwest corner of sec. 23, T. 12 N., R. 5 W. (Colors are for dry soil unless otherwise stated.)

Ap—0 to 8 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate fine granular structure; very hard, very firm; few fine and medium roots; calcareous; slightly alkaline; abrupt smooth boundary. (0 to 10 inches thick)

A—8 to 22 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; strong fine granular and subangular blocky structure; very hard, very firm; few fine and medium roots; slightly effervescent; moderately alkaline; gradual wavy boundary. (12 to 34 inches thick)

Bssk—22 to 50 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate coarse blocky structure; extremely hard, extremely firm; shiny pressure faces on faces of peds; few slickensides; few parallelepipedes; dark soil material with moist color of black (10YR 2/1) in some cracks; common fine and medium calcium carbonate concretions; strongly effervescent; moderately alkaline; gradual wavy boundary. (14 to 36 inches thick)

Ck—50 to 72 inches; light brown (7.5YR 6/4) silty clay, dark brown (7.5YR 4/4) moist; massive; extremely hard, extremely firm; few reddish brown (5YR 5/4) bodies of

silty clay; common medium and coarse concretions of calcium carbonate; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 38 to 60 inches

Other features: Parallel, piped-shaped aggregates are evident when the soil is nearly dry but are not evident when the soil is moist; slickensides within a depth of 40 inches; when dry, the soil has cracks ranging from 1 to 2 cm in width at a depth of 20 inches; distance between the center of the microhigh and the center of the microlow ranges from 8 to 12 1/2 feet

A horizon:

Color—hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 1

Texture—clay, silty clay, clay loam, or silty clay loam

Reaction—slightly alkaline or moderately alkaline and slightly effervescent in the microhigh; neutral to moderately alkaline in the microlow

Clay content—35 to 60 percent

Thickness—varies from 12 inches in the microhigh to 40 inches in the microlow

Bssk horizon:

Color—hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4

Texture—clay, silty clay, clay loam, or silty clay loam

Reaction—slightly alkaline or moderately alkaline and slightly effervescent

Clay content—35 to 60 percent

Other characteristics—horizon has cracks that are filled with dark material like the A horizon in most pedons

Ck horizon:

Color—hue of 5YR to 10YR, value of 4 to 6, and chroma of 2 to 4

Texture—clay, silty clay, clay loam, or silty clay loam

Reaction—slightly alkaline or moderately alkaline; slightly effervescent to strongly effervescent

Clay content—35 to 50 percent

Wisby Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Drainage class: Somewhat excessively drained

Parent material and geologic age: Loamy sediments over old sandy alluvium of Pleistocene age

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Upland

Landform: Dissected terrace

Landform position: Tread

Slope range: 0 to 20 percent

Slope shape: Convex-convex

Elevation range: 1,200 to 2,000 feet

Mean annual precipitation: 26 to 38 inches

Mean annual air temperature: 57 to 62 degrees F

Frost-free days: 185 to 210

Thorntwaite PE index: 44 to 64

Taxonomic class: Coarse-loamy, mixed, superactive, thermic Udic Argiustolls

Associated Soils

- Fine-loamy Milan and Lovedale soils which do not have a gravelly substratum; generally in the slightly higher landscape positions

Typical Pedon

Wisby sandy loam; Alfalfa County, Oklahoma; about 2,300 feet west and 300 feet south of the northwest corner of sec. 1, T. 24 N., R. 10 W. (Colors are for dry soil unless otherwise stated.)

A—0 to 12 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; moderate medium granular structure; hard, friable; noneffervescent; neutral; gradual smooth boundary. (8 to 18 inches thick)

Bt—12 to 24 inches; brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 3/4) moist; weak coarse prismatic structure parting to weak medium granular; slightly hard, friable; few faint patchy clay films on faces of peds; common clay bridging between sand grains; noneffervescent; neutral; gradual smooth boundary. (12 to 20 inches thick)

2C—24 to 80 inches; strong brown (7.5YR 5/6) gravelly sand, strong brown (7.5YR 4/6) moist; single grained; noneffervescent; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches

Thickness of the solum: 20 to 40 inches

Depth to carbonates: More than 36 inches

A horizon:

Color—hue of 7.5YR or 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 2 or 3

Texture—sandy loam or fine sandy loam

Reaction—neutral to moderately acid

Content and size of coarse fragments—0 to 15 percent, by volume, rounded gravel less than 3 inches in diameter

Bt horizon:

Color—hue of 2.5YR to 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 6

Texture—sandy loam or loam that has 10 to 18 percent clay and 45 to 75 percent medium and coarse sand

Reaction—slightly acid to slightly alkaline

Content and size of coarse fragments—0 to 15 percent, by volume, rounded gravel less than 3 inches in diameter

BC horizon (if it occurs):

Color—hue of 2.5YR to 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 6

Texture—coarse sandy loam, sandy loam, or loamy sand

Reaction—neutral to moderately alkaline

2C horizon:

Color—hue of 5YR or 7.5YR, value of 4 to 6 (4 or 5 moist), and chroma of 4 to 8

Texture—sand, gravelly sand, or loamy sand

Reaction—slightly acid to moderately alkaline

Content of coarse fragments—0 to 40 percent, by volume, rounded gravel less than 3 inches in diameter

Yahola Series

Major land resource area: Central Rolling Red Prairies (80A)

Depth class: Very deep

Soil Survey of Canadian County, Oklahoma

Drainage class: Well drained

Parent material and geologic age: Recent calcareous loamy alluvium

Physiographic region: Interior Lowlands

Physiographic province: Central Lowland

Physiographic sub-province: Osage Plain

Landscape: Valley

Landform: Low flood plain

Slope range: 0 to 2 percent

Slope shape: Linear-linear

Elevation range: 800 to 1,300 feet

Mean annual precipitation: 26 to 40 inches

Mean annual air temperature: 57 to 64 degrees F

Frost-free days: 190 to 230

Thorntwaite PE index: 44 to 64

Taxonomic class: Coarse-loamy, mixed, superactive, calcareous, thermic Udic
Ustifluvents

Associated Soils

- Canadian and Dale soils which have mollic surface layers; in the slightly higher areas
- Gaddy soils which are loamy fine sand or coarser material throughout the textural control section; in the slightly lower areas
- Gracemont and Gracemore soils which have a water table within a depth of 40 inches; in the slightly lower areas
- Miller soils which have a fine textural control section and have a mollic epipedon; in nearby areas
- Port soils which have a fine-silty textural control section and have a mollic epipedon; in nearby areas
- Pulaski soils which are in nearby areas
- Reinach soils which have a mollic epipedon and a coarse-silty textural control section; in the higher areas

Typical Pedon

Yahola fine sandy loam; Jefferson County, Oklahoma; about 7 miles west and 1 mile north of Ryan, about 2,000 feet north and 200 feet east of the southwest corner of sec. 18, T. 6 S., R. 8 W. (Colors are for dry soil unless otherwise stated.)

Ap—0 to 11 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine granular structure; soft, very friable; calcareous; moderately alkaline; gradual smooth boundary.

C1—11 to 40 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; massive; slightly hard, very friable; thin strata of loamy fine sand and silt loam in the lower part; calcareous; moderately alkaline; gradual smooth boundary.

C2—40 to 56 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; massive; slightly hard, friable; calcareous; moderately alkaline; gradual smooth boundary.

C3—56 to 72 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; thin strata of loamy fine sand to clay loam; calcareous; moderately alkaline.

Range in Characteristics

A horizon:

Color—hue of 2.5YR to 7.5YR, value of 4 to 7 (3 to 6 moist), and chroma of 2 to 6;

Soil Survey of Canadian County, Oklahoma

where value is 5.5 or less (3 moist), chroma is 3.5 or less, and the horizon is more than 10 inches thick, the organic matter content is less than 1 percent
Texture—loamy fine sand, fine sandy loam, very fine sandy loam, or loam; where the horizon is loamy fine sand, it is less than 12 inches thick
Reaction—slightly alkaline or moderately alkaline; typically calcareous

C1 horizon:

Color—hue of 2.5YR to 7.5YR, value of 5 to 7 (4 to 6 moist), and chroma of 3 to 8
Texture—fine sandy loam, very fine sandy loam, or loam; thin strata of coarser or finer materials occur throughout horizon
Clay content—5 to 18 percent above a depth of 40 inches
Reaction—moderately alkaline; calcareous

C2 and C3 horizons:

Color—hue of 2.5YR to 7.5YR, value of 5 to 7 (4 to 6 moist), and chroma of 3 to 8
Texture—fine sandy loam, loam, silt loam, or loamy fine sand; thin strata of coarser or finer materials occur throughout horizon
Clay content—5 to 18 percent above a depth of 40 inches
Reaction—moderately alkaline; calcareous

Soil Survey of Canadian County, Oklahoma

Classification of the Soils

Soil name	Family or higher taxonomic class
Bethany-----	Fine, mixed, superactive, thermic Pachic Paleustolls
Binger-----	Fine-loamy, mixed, active, thermic Udic RhodustalFs
Brewer-----	Fine, mixed, superactive, thermic Udertic Argiustolls
Canadian-----	Coarse-loamy, mixed, superactive, thermic Udic Haplustolls
Dale-----	Fine-silty, mixed, superactive, thermic Pachic Haplustolls
Darnell-----	Loamy, siliceous, active, thermic, shallow Udic Haplustepts
Dill-----	Coarse-loamy, mixed, active, thermic Udic Haplustepts
Drummond-----	Fine, mixed, superactive, thermic Mollic NatrustalFs
Goodnight-----	Mixed, thermic Typic Ustipsamments
Gracemore-----	Sandy, mixed, thermic Oxyaquic Udifluvents
Grainola-----	Fine, mixed, active, thermic Udertic HaplustalFs
Grant-----	Fine-silty, mixed, superactive, thermic Udic Argiustolls
Ironmound-----	Loamy, mixed, active, thermic, shallow Udic Haplustepts
Kingfisher-----	Fine-silty, mixed, active, thermic Udic Argiustolls
Kirkland-----	Fine, mixed, superactive, thermic Udertic Paleustolls
Konawa-----	Fine-loamy, mixed, active, thermic Ultic HaplustalFs
Lovedale-----	Fine-loamy, mixed, superactive, thermic Udic Argiustolls
McLain-----	Fine, mixed, superactive, thermic Pachic Argiustolls
Minco-----	Coarse-silty, mixed, superactive, thermic Udic Haplustolls
Nash-----	Coarse-silty, mixed, superactive, thermic Udic Haplustolls
Noble-----	Coarse-loamy, siliceous, active, thermic Udic Haplustepts
Norge-----	Fine-silty, mixed, active, thermic Udic Paleustolls
Pawhuska-----	Fine, mixed, superactive, thermic Mollic NatrustalFs
Pond Creek-----	Fine-silty, mixed, superactive, thermic Pachic Argiustolls
Port-----	Fine-silty, mixed, superactive, thermic Cumulic Haplustolls
Reinach-----	Coarse-silty, mixed, superactive, thermic Pachic Haplustolls
Renfrow-----	Fine, mixed, superactive, thermic Udertic Paleustolls
Watonga-----	Fine, smectitic, thermic Udic Haplusterts
Wisby-----	Coarse-loamy, mixed, superactive, thermic Udic Argiustolls
Yahola-----	Coarse-loamy, mixed, superactive, calcareous, thermic Udic Ustifluvents

Formation of the Soils

This section relates the soils in the survey area to the major factors of soil formation.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic agents. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or the lay of the land; and the length of time that the forces of soil development have acted on the soil material.

Parent Material

Soils form in unconsolidated material that influences the rate of formation; the chemical, physical, and mineral composition of the soil; and the color of the soil.

Soils on the dissected uplands in Canadian County formed in residual material weathered from sandstone, clay, and shale. Soils that developed in residual material weathered from Permian rocks include Ironmound, Nash, Binger, and Darnell.

Soils on the smoother uplands formed from ancient alluvial sediment consisting of sand, silt, and clay. Soils that formed in ancient alluvium include Bethany, Kirkland, and Renfrow.

Alluvial sediment is extensive along streams and rivers of the county. The kind of sediment deposited and the kinds of soil that formed in it largely depend on the source of the sediment and the velocity of the streams. Soils that formed in recent alluvial sediments are Canadian, Dale, Gracemore, Watonga, and Yahola.

Climate

Canadian County has a dry, subhumid climate. Because the climate is uniform throughout the county, differences among soils cannot be attributed to differences in climate based on the present climatic regime. Moisture and warm temperatures have been sufficient to promote the formation of distinct layers in many of the soils. Soil leaching is slow or moderate. The physical abrasion and redistribution of materials by wind action contributes to soil formation. Cold temperatures occur often enough and long enough in the survey area to alter materials through the forces of freezing and thawing.

Living Organisms

Plants, burrowing animals, insects, and micro-organisms have a direct influence on the formation of soils. The native grasses and trees in the county have had different effects on the losses and gains of organic matter and plant nutrients and on soil structure and porosity. Soils that formed under prairie vegetation, such as Bethany and

Grant, have a dark grayish brown surface layer and a moderately high content of organic matter. Soils that formed under trees, such as Konawa, have a grayish brown surface layer and a low content of organic matter.

Topography

Relief influences the formation of the soils mainly through its effect on water movement, erosion, soil temperature, and the kind of plant cover. In Canadian County, relief is determined largely by the resistance of underlying formations to weathering and geological erosion. The topography of the northern part of Canadian County is more level and stable. In this area, the soil-forming processes are more intense than in the southern part of the county. In the southern part, the soils are generally deeper and more developed. The more dissected topography of this area has more runoff and erosion, and the soils are moderately deep or shallow and less developed.

Time

As a factor in soil formation, time is difficult to measure in years. The length of time needed for development of genetic horizons depends on the intensity and the interactions of the other soil-forming factors in promoting the loss, gain, transfer, or transformation of the constituents that make up soil horizons. Soils that have no definite genetic horizons are young or immature. Mature or older soils are in equilibrium with their environment and tend to have well defined horizons.

The soils in Canadian County range from young to old. Bethany and Kirkland soils are examples of old soils. Kingfisher and Grant soils are younger, but they have well expressed horizons. Darnell and Ironmound soils are considered young soils. Although these soils have had sufficient time to develop well expressed horizons, geological erosion has taken away soil material almost as fast as it has formed because these soils are in sloping areas. Gracemore and Yahola soils are young soils that formed in recent sediments on flood plains. These soils show little horizon development.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as gravel, sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Backslope. The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Backslopes in profile are commonly steep, are linear, and may or may not include cliff segments.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

- Bedding planes.** Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.
- Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
- Bench terrace.** A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.
- Blowout.** A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts, the water table is exposed.
- Bottom land.** The normal flood plain of a stream, subject to flooding.
- Boulders.** Rock fragments larger than 2 feet (60 centimeters) in diameter.
- Breaks.** The steep and very steep broken land at the border of an upland summit that is dissected by ravines.
- Brush management.** Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.
- Butte.** An isolated small mountain or hill with steep or precipitous sides and a top variously flat, rounded, or pointed that may be a residual mass isolated by erosion or an exposed volcanic neck.
- Calcareous soil.** A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.
- Caliche.** A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds directly beneath the solum, or it is exposed at the surface by erosion.
- Canyon.** A long, deep, narrow, very steep-sided valley with high, precipitous walls in an area of high local relief.
- Capillary water.** Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.
- Catena.** A sequence of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.
- Cation.** An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.
- Cation-exchange capacity.** The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.
- Cemented.** Material in an air-dry test specimen that does not slake after being immersed in water for 1 hour. Cemented soil material has a brittle, hard consistence caused by some cementing agent other than clay. Calcium carbonate, silica, or oxides or salts of iron and aluminum are common cementing materials.
- Channeled.** Refers to a drainage area in which natural meandering or repeated branching and convergence of a streambed have created deeply incised cuts, either active or abandoned, in alluvial material.
- Channery soil material.** Soil material that is, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

- Chemical treatment.** Control of unwanted vegetation through the use of chemicals.
- Chiseling.** Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.
- Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
- Clay depletions.** Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.
- Clayey soil.** Silty clay, sandy clay, or clay.
- Clay film.** A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.
- Claypan.** A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.
- Climax plant community.** The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.
- Closed depression.** A low area completely surrounded by higher ground and having no natural outlet.
- Coarse fragments.** Mineral or rock particles larger than 2 millimeters in diameter.
- Coarse textured soil.** Sand or loamy sand.
- Cobble (or cobblestone).** A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.
- Cobbly soil material.** Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.
- Colluvium.** Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.
- Complex slope.** Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.
- Complex, soil.** A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.
- Compressible** (in tables). Excessive decrease in volume of soft soil under load.
- Concretions.** Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.
- Conglomerate.** A coarse-grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.
- Conservation cropping system.** Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

- Conservation tillage.** A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.
- Consistence, soil.** Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."
- Consolidated sandstone.** Sandstone that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry, are not easily crushed, and cannot be textured by the usual field method.
- Consolidated shale.** Shale that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry and are not easily crushed.
- Consolidated siltstone.** Siltstone that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry and are not easily crushed.
- Contour stripcropping.** Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.
- Control section.** The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many, it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.
- Coppice dune.** A small dune of fine-grained soil material stabilized around shrubs or small trees.
- Corrosion.** Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.
- Cover crop.** A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.
- Cropping system.** Growing crops according to a planned system of rotation and management practices.
- Crop residue management.** Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.
- Cuesta.** A hill or ridge that has a gentle slope on one side and a steep slope on the other; specifically, an asymmetric, homoclinal ridge capped by resistant rock layers of slight or moderate dip.
- Cutbanks cave** (in tables). The walls of excavations tend to cave in or slough.
- Decreasers.** The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.
- Deep soil.** A soil that is 40 to 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.
- Deferred grazing.** Postponing grazing or resting grazing land for a prescribed period.
- Dense layer** (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.
- Depth, soil.** Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep soils, 20 to 40 inches; shallow soils, 10 to 20 inches; and very shallow soils, less than 10 inches.
- Depth to rock** (in tables). Bedrock is too near the surface for the specified use.

- Dip slope.** A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.
- Diversion (or diversion terrace).** A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.
- Drainage class (natural).** Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained*. These classes are defined in the “Soil Survey Manual.”
- Drainage, surface.** Runoff, or surface flow of water, from an area.
- Drainageway.** An area of ground at a lower elevation than the surrounding ground and in which water collects and is drained to a closed depression or lake or to a drainageway at a lower elevation. A drainageway may or may not have distinctly incised channels at its upper reaches or throughout its course.
- Draw.** A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.
- Dune.** A mound, ridge, or hill of loose, windblown granular material (generally sand), either bare or covered with vegetation.
- Ecological site.** An area of rangeland or forestland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind or proportion of species or total production.
- Eluviation.** The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.
- Endosaturation.** A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.
- Eolian soil material.** Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.
- Ephemeral stream.** A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.
- Episaturation.** A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.
- Erosion.** The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.
- Escarpment.** A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.
- Excess fines** (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Footslope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter. Very gravelly soil material has 35 to 60 percent of these rock fragments, and extremely gravelly soil material has more than 60 percent.

- Green manure crop (agronomy).** A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.
- Ground water.** Water filling all the unblocked pores of the material below the water table.
- Gully.** A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.
- Gypsum.** A mineral consisting of hydrous calcium sulfate.
- Hard bedrock.** Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.
- Hardpan.** A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.
- Heavy metal.** Inorganic substances that are solid at ordinary temperatures and are not soluble in water. They form oxides and hydroxides that are basic. Examples are copper, iron, cadmium, zinc, manganese, lead, and arsenic.
- Hemic soil material (mucky peat).** Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.
- High-residue crops.** Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.
- Hill.** A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.
- Horizon, soil.** A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:
- O horizon.*—An organic layer of fresh and decaying plant residue.
- A horizon.*—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.
- E horizon.*—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.
- B horizon.*—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.
- C horizon.*—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.
- Cr horizon.*—Soft, consolidated bedrock beneath the soil.
- R layer.*—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements.

Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loamy soil. Coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, or silty clay loam.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mesa. A broad, nearly flat-topped and commonly isolated upland mass characterized by summit widths that are more than the heights of bounding erosional scarps.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Microhigh. An area that is 2 to 12 inches higher than the adjacent microlow.

Microlow. An area that is 2 to 12 inches lower than the adjacent microhigh.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

- Miscellaneous area.** An area that has little or no natural soil and supports little or no vegetation.
- Moderately coarse textured soil.** Coarse sandy loam, sandy loam, or fine sandy loam.
- Moderately deep soil.** A soil that is 20 to 40 inches deep over bedrock or to other material that restricts the penetration of plant roots.
- Moderately fine textured soil.** Clay loam, sandy clay loam, or silty clay loam.
- Mollic epipedon.** A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.
- Morphology, soil.** The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.
- Mottling, soil.** Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).
- Mudstone.** Sedimentary rock formed by induration of silt and clay in approximately equal amounts.
- Munsell notation.** A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.
- Natric horizon.** A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.
- Neutral soil.** A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)
- Nodules.** Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.
- Nutrient, plant.** Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.
- Organic matter.** Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:
- | | |
|----------------------|-----------------------|
| Very low | less than 0.5 percent |
| Low | 0.5 to 1.0 percent |
| Moderately low | 1.0 to 2.0 percent |
| Moderate | 2.0 to 4.0 percent |
| High | 4.0 to 8.0 percent |
| Very high | more than 8.0 percent |
- Oxbow.** The horseshoe-shaped channel of a former meander, remaining after the stream formed a cutoff across a narrow meander neck.
- Pan.** A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, hardpan, fragipan, claypan, plowpan, and traffic pan.
- Parent material.** The unconsolidated organic and mineral material in which soil forms.
- Pebble.** See Gravel.
- Ped.** An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher areas of the erosion surface.

Pedon. The smallest volume that can be called “a soil.” A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as “saturated hydraulic conductivity,” which is defined in the “Soil Survey Manual.” In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as “permeability.” Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.00 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas. Temporary flooding occurs primarily in response to precipitation and runoff.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse-grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could

penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannahs, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Red beds. Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

- Relict stream terrace.** One of a series of platforms in or adjacent to a stream valley that formed prior to the current stream system.
- Relief.** The elevations or inequalities of a land surface, considered collectively.
- Residuum (residual soil material).** Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.
- Ridge.** A long, narrow elevation of the land surface. It generally is sharp crested and forms an extended upland between valleys.
- Rill.** A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.
- Riser.** The relatively short, steeply sloping area below a terrace tread that grades to a lower terrace tread or base level.
- Riverwash.** Unstable areas of sandy, silty, clayey, or gravelly sediments. These areas are flooded, washed, and reworked by rivers so frequently that they support little or no vegetation.
- Road cut.** A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.
- Rock fragments.** Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.
- Rock outcrop.** Exposures of bare bedrock other than lava flows and rock-lined pits.
- Rooting depth** (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.
- Root zone.** The part of the soil that can be penetrated by plant roots.
- Rubble land.** Areas that have more than 90 percent of the surface covered by stones or boulders. Voids contain no soil material and virtually no vegetation other than lichens. The areas commonly are at the base of mountain slopes, but some are on mountain slopes as deposits of cobbles, stones, and boulders left by Pleistocene glaciation or by periglacial phenomena.
- Runoff.** The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.
- Saline soil.** A soil containing soluble salts in an amount that impairs the growth of plants. A saline soil does not contain excess exchangeable sodium.
- Salinity.** The electrical conductivity of a saline soil. It is expressed, in millimhos per centimeter, as follows:
- | | |
|----------------------------|--------------|
| Nonsaline | 0 to 2 |
| Very slightly saline | 2 to 4 |
| Slightly saline | 4 to 8 |
| Moderately saline | 8 to 16 |
| Strongly saline | more than 16 |
- Sand.** As a soil separate, individual rock or mineral fragments ranging from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.
- Sandstone.** Sedimentary rock containing dominantly sand-sized particles.
- Sandy soil.** Sand or loamy sand.
- Sapric soil material (muck).** The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.
- Saturation.** Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

- Scarification.** The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.
- Second bottom.** The first terrace above the normal flood plain (or first bottom) of a river.
- Sediment.** Solid, clastic material, both mineral and organic, that is in suspension, is being transported or has been moved from its site of origin by water, wind, ice, or mass wasting, and has come to rest on the earth's surface either above or below sea level.
- Sedimentary plain.** An extensive nearly level to gently rolling or moderately sloping area that is underlain by sedimentary bedrock and that has a slope of 0 to 8 percent.
- Sedimentary rock.** Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.
- Sedimentary uplands.** Land areas of bedrock formed from water- or wind-deposited sediments. They are higher on the landscape than the flood plain.
- Seepage** (in tables). The movement of water through the soil. Seepage adversely affects the specified use.
- Semiconsolidated sedimentary beds.** Soft geologic sediments that disperse when fragments are placed in water. The fragments are hard or very hard when dry. Determining the texture by the usual field method is difficult.
- Sequum.** A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)
- Series, soil.** A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.
- Shale.** Sedimentary rock formed by the hardening of a clay deposit.
- Shallow soil.** A soil that is 10 to 20 inches deep over bedrock or to other material that restricts the penetration of plant roots.
- Sheet erosion.** The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.
- Shoulder slope.** The uppermost inclined surface at the top of a hillside. It is the transition zone from the backslope to the summit of a hill or mountain. The surface is dominantly convex in profile and erosional in origin.
- Shrink-swell** (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.
- Silica.** A combination of silicon and oxygen. The mineral form is called quartz.
- Silt.** As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.
- Siltstone.** Sedimentary rock made up of dominantly silt-sized particles.
- Similar soils.** Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.
- Similarity index.** The present composition of the plant community on a ecological site in relation to the potential natural plant community for that site. Similarity index is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.
- Sinkhole.** A depression in the landscape where limestone has been dissolved.
- Slickensides.** Polished and grooved surfaces produced by one mass sliding past

another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the following slope classes are recognized:

Nearly level	0 to 1 percent
Very gently sloping	1 to 3 percent
Gently sloping	3 to 5 percent
Moderately sloping	5 to 8 percent
Strongly sloping	8 to 12 percent
Moderately steep	12 to 20 percent
Steep	20 to 45 percent
Very steep	45 percent and higher

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $\text{Ca}^{++} + \text{Mg}^{++}$. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13 to 30:1
Strong	more than 30:1

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Species. A single, distinct kind of plant or animal having certain distinguishing characteristics.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Strath terrace. A surface cut formed by the erosion of hard or semiconsolidated bedrock and thinly mantled with stream deposits.

Stream channel. The hollow bed where a natural stream of surface water flows or may flow; the deepest or central part of the bed, formed by the main current and covered more or less continuously by water.

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel. It originally formed near the level of the stream and is the dissected remnants of an abandoned flood plain, streambed, or valley floor that were produced during a former stage of erosion or deposition.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit. A general term for the top, or highest level, of an upland feature, such as a hill or mountain. It commonly refers to a higher area that has a gentle slope and is flanked by steeper slopes.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil,

ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Tailwater. The water directly downstream of a structure.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill; part of a footslope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Trafficability. The degree to which a soil is capable of supporting vehicular traffic across a wide range in soil moisture conditions.

Tread. The relatively flat terrace surface that was cut or built by stream or wave action.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley. An elongated depressional area primarily developed by stream action.

Valley fill. Alluvium deposited by heavily loaded streams.

Variation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Very deep soil. A soil that is more than 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

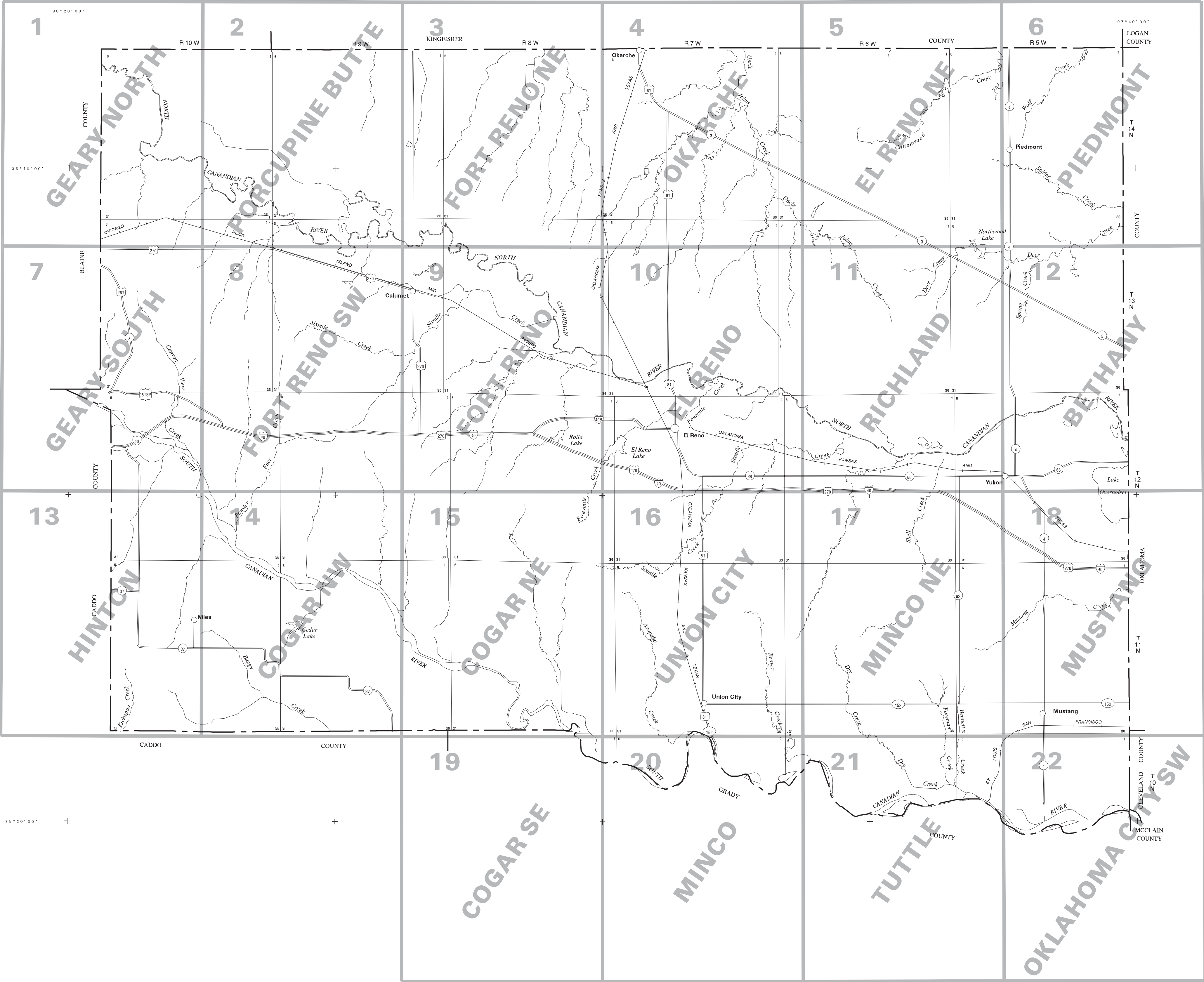
Very shallow soil. A soil that is less than 10 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Well graded. Refers to soil material consisting of coarse-grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

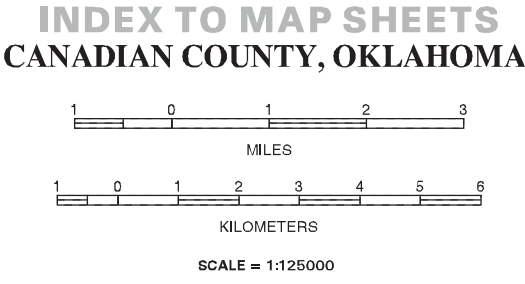
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SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



SOIL LEGEND

Map symbols consist of letters or a combination of letters and numbers. The first letter is always a capital. The second letter is generally lowercase. The third letter, if present, is a capital letter that shows the slope class, except for miscellaneous areas. Symbols with all uppercase letters represent miscellaneous areas. Most symbols without a third letter are those of nearly level soils. The fourth symbol, when used, is a number indicating erosion class.

SYMBOL	NAME
BeA	Bethany silt loam, 0 to 1 percent slopes
BnC	Binger fine sandy loam, 3 to 5 percent slopes
Br	Brewer silty clay loam, 0 to 1 percent slopes, rarely flooded
Bu	Brewer-Drummond complex, 0 to 1 percent slopes, rarely flooded
Ca	Canadian fine sandy loam, 0 to 1 percent slopes, rarely flooded
Da	Dale silt loam, 0 to 1 percent slopes, rarely flooded
DAM	Large dam
DnD	Darnell-Noble complex, 5 to 15 percent slopes
DnF	Darnell-Noble complex, 15 to 30 percent slopes
DuD	Dill-Ironmound complex, 5 to 8 percent slopes
DUM	Dumps
Ga	Gracemore loamy fine sand, 0 to 1 percent slopes, occasionally flooded
Gb	Gracemore soils, 0 to 1 percent slopes, frequently flooded
GdB	Konawa fine sandy loam, 1 to 3 percent slopes
GdC	Konawa fine sandy loam, 3 to 5 percent slopes
GdC2	Konawa fine sandy loam, 3 to 5 percent slopes, eroded
GdD	Konawa fine sandy loam, 5 to 8 percent slopes
GdD3	Konawa fine sandy loam, 3 to 8 percent slopes, severely eroded
GhB	Grant-Pawhuska complex, 1 to 3 percent slopes
GpE	Grant-Port complex, 0 to 12 percent slopes
GuD	Grant-Ironmound complex, 5 to 8 percent slopes
GuD2	Grant-Ironmound complex, 3 to 8 percent slopes, eroded
KfB	Kingfisher silt loam, 1 to 3 percent slopes
KfC	Kingfisher silt loam, 3 to 5 percent slopes
KrA	Kirkland silt loam, 0 to 1 percent slopes
KrB	Kirkland silt loam, 1 to 3 percent slopes
KsB	Kirkland-Pawhuska complex, 1 to 3 percent slopes
KwD	Konawa loamy fine sand, 3 to 8 percent slopes
M-W	Miscellaneous water
Mc	McLain silty clay loam, 0 to 1 percent slopes, rarely flooded
MnD	Minco very fine sandy loam, 5 to 8 percent slopes
MnF	Minco very fine sandy loam, 8 to 30 percent slopes
MsB	Minco silt loam, 1 to 3 percent slopes
MsC	Minco silt loam, 3 to 5 percent slopes
NaD	Nash-Ironmound complex, 3 to 8 percent slopes
NaD2	Nash-Ironmound complex, 3 to 8 percent slopes, eroded
NaD3	Nash-Ironmound complex, 3 to 8 percent slopes, severely eroded
NbC	Noble fine sandy loam, 3 to 5 percent slopes
NrB	Norge silt loam, 1 to 3 percent slopes
NrC	Norge silt loam, 3 to 5 percent slopes
NrD	Norge silt loam, 5 to 8 percent slopes
PtT	Pits
PkA	Pond Creek silt loam, 0 to 1 percent slopes
PkB	Pond Creek silt loam, 1 to 3 percent slopes
Po	Port silt loam, 0 to 1 percent slopes, occasionally flooded
Pw	Port silty clay loam, 0 to 1 percent slopes, frequently flooded
QdE	Ironmound-Dill complex, 5 to 12 percent slopes
QrF	Ironmound-Rock outcrop complex, 12 to 30 percent slopes
Ra	Reinach very fine sandy loam, 0 to 1 percent slopes, rarely flooded
RbA	Renfrow silt loam, 0 to 1 percent slopes
RbB	Renfrow silt loam, 1 to 3 percent slopes
RcC2	Renfrow clay loam, 3 to 5 percent slopes, eroded
ShB	Lovedale fine sandy loam, 1 to 3 percent slopes
ShC	Lovedale fine sandy loam, 3 to 5 percent slopes
ShD	Lovedale fine sandy loam, 5 to 8 percent slopes
ShD2	Lovedale fine sandy loam, 5 to 8 percent slopes, eroded
SnE	Lovedale-Wisby complex, 5 to 12 percent slopes
Tv	Goodnight fine sand, 15 to 30 percent slopes
VeC	Grainola clay loam, 3 to 5 percent slopes
VrE	Grainola-Rock outcrop complex, 5 to 15 percent slopes
VsC2	Grainola soils, 3 to 5 percent slopes, eroded
W	Water
Wa	Watonga silty clay, 0 to 1 percent slopes, rarely flooded
Ya	Yahola fine sandy loam, 0 to 1 percent slopes, occasionally flooded

CONVENTIONAL AND SPECIAL
SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

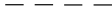
National, state, or province



County or parish



Minor civil division



Reservation (national forest or park,
state forest or park)



Land grant



Limit of soil survey (label)
and/or denied access area



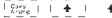
Field sheet matchline and neatline



Previously published survey



OTHER BOUNDARY (label)



Airport, airfield



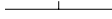
Cemetery



City/county park



STATE COORDINATE TICK
1 890 000 FEET



LAND DIVISION CORNER
(section and land grants)



GEOGRAPHIC COORDINATE TICK



TRANSPORTATION

Divided roads



Other roads



Trail



ROAD EMBLEMS AND DESIGNATIONS

Interstate



Federal



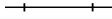
State



County, farm or ranch



RAILROAD



POWER TRANSMISSION LINE
(normally not shown)



PIPE LINE (normally not shown)



FENCE (normally not shown)



LEVEES

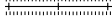
Without road



With road



With railroad

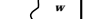


Single side slope
(showing actual feature location)



DAMS

Medium or small



LANDFORM FEATURES

Prominent hill or peak



Soil sampling site



MISCELLANEOUS CULTURAL FEATURES

Farmstead, house (omit in urban areas)



Church



School



Other religion (label)



Located object (label)



Tank (label)



Lookout tower



Oil and/or natural gas wells



Windmill



Lighthouse



HYDROGRAPHIC FEATURES

STREAMS

Perennial stream, double line



Perennial stream, single line



Intermittent stream



Drainage end



DRAINAGE AND IRRIGATION

Double-line canal (label)



Perennial drainage and/or irrigation
ditch



Intermittent drainage and/or irrigation
ditch



SMALL LAKES, PONDS, AND RESERVOIRS

Perennial water



Miscellaneous water



Flood pool line



MISCELLANEOUS WATER FEATURES

Spring



Well, artesian



Well, irrigation



SPECIAL SYMBOLS FOR SOIL
SURVEY AND SSURGO

SOIL DELINEATIONS AND SYMBOLS



LANDFORM FEATURES

Bedrock escarpment



Other than bedrock escarpment



Short steep slope



Gully



Depression, closed



Sinkhole



EXCAVATIONS

Borrow pit



Gravel pit



Mine or quarry



Landfill



MISCELLANEOUS SURFACE FEATURES

Blowout



Clay spot



Gravelly spot



Lava spot



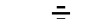
Marsh or swamp



Rock outcrop



Saline spot



Sandy spot



Severely eroded spot



Slide or slip



Sodic spot



Spoil area



Stony spot



Wet spot



Very stony spot

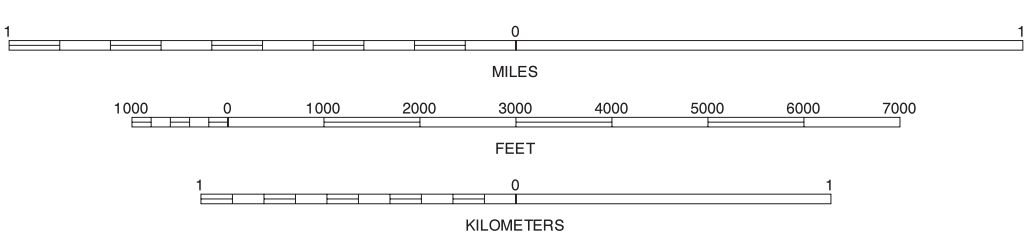
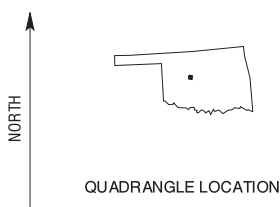


Joins sheet 8,
Fort Reno SW



This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1995 aerial photography.

North American Datum of 1983 (NAD83), GRS-80 Spheroid
1000-meter ticks: Universal Transverse Mercator, zone 14.
Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



1	3
7	9

1 GEARY NORTH
3 FORT RENO NE
7 GEARY SOUTH
9 FORT RENO SW
9 FORT RENO

PORCUPINE BUTTE, OKLAHOMA
7.5 MINUTE SERIES
SHEET NUMBER 2 OF 22

Soil map delineations extending beyond the dashed white quadrangle neckline are for reference only and are included on adjacent map sheets.

98° 07' 30"

98° 05' 00"

98° 02' 30"

98° 00' 00"



Joins sheet 4, Okarche

Joins sheet 8,
Fort Reno SW

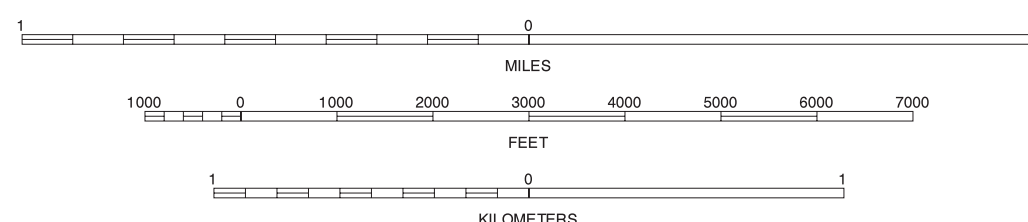
North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000-meter ticks: Universal Transverse Mercator, zone 14.
Coordinate grid ticks and land division data, if shown, are
approximately positioned. Digital data are available for
this quadrangle.



QUADRANGLE LOCATION

.Joins sheet 9 Fort Reno

SCALE 1:24000



2		4	
8	9	10	

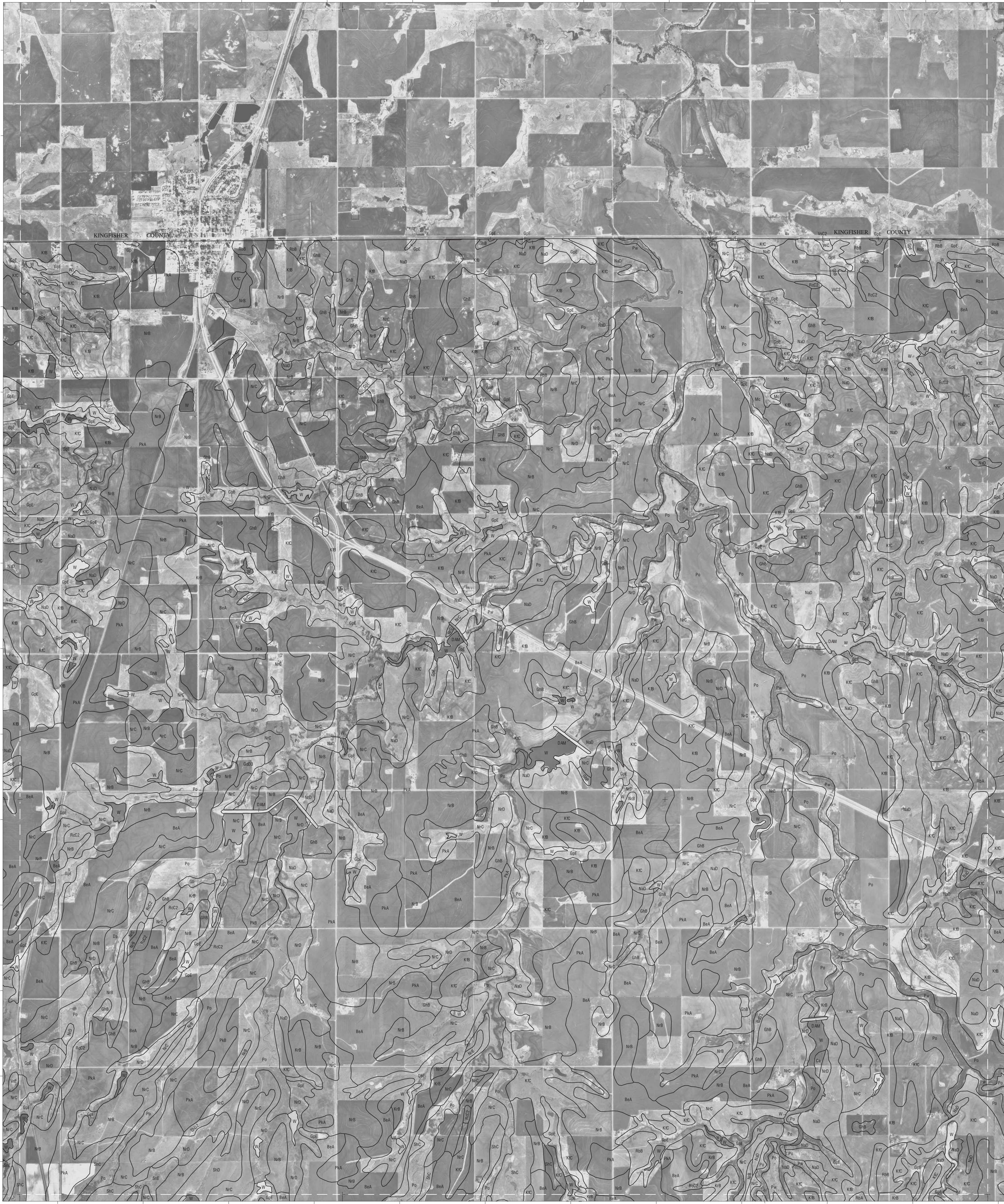
2 PORCUPINE BUTTE
4 OKARCHE
8 FORT RENO SW
9 FORTRENO
10 EL RENO

INDEX TO ADJOINING 7.5 MAPS

SHEET NUMBER 3 OF 22

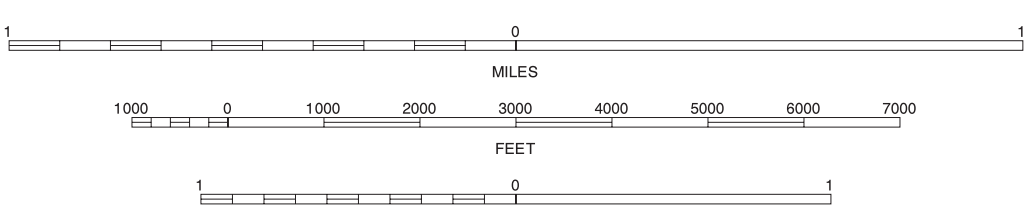
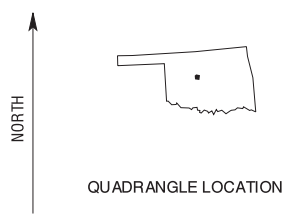
Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

Joins sheet 10,
El Reno



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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



3	5
9	11

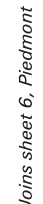
3 FORTRENO NE
5 ELRENO NE
9 FORTRENO
10 ELRENO
11 RICHLAND

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OKARCHE, OKLAHOMA
7.5 MINUTE SERIES
SHEET NUMBER 4 OF 22

Soil map delineations extending beyond the dashed white quadrangle nealline are for reference only and are included on adjacent map sheets.

97° 45' 00"



Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

Joins sheet 12,
Bethany

CANADIAN COUNTY, OKLAHOMA
PIEDMONT QUADRANGLE
SHEET NUMBER 6 OF 22

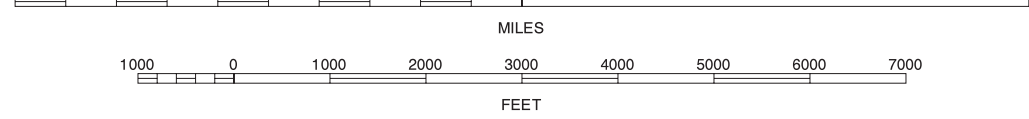


North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000-meter ticks: Universal Transverse Mercator, zone 14.
Coordinate grid ticks and land division data, if shown, are
approximately positioned. Digital data are available for
this quadrangle.



Joins sheet 12, Bethany

SCALE 1:24000

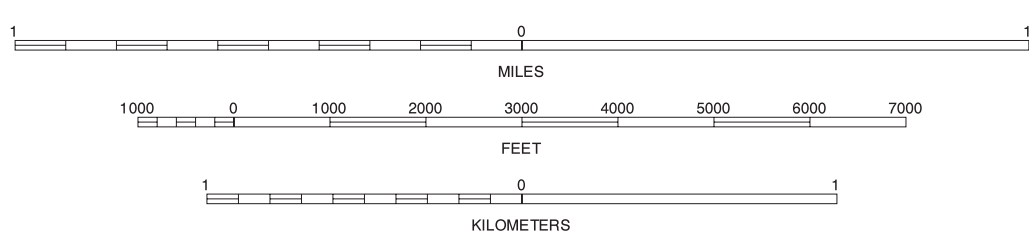
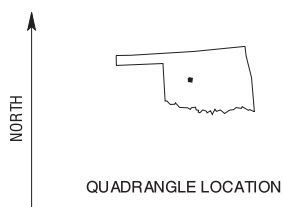


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North American Datum of 1983 (NAD83), GRS-80 Spheroid
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1	2	1 GEARY NORTH
		2 PORCUPINE BUTTE
8		8 FORT RENO SW
13	14	13 HINTON
		14 CEDAR NW

INDEX TO ADJOINING 7.5 MAPS

GEARY SOUTH, OKLAHOMA
7.5 MINUTE SERIES
SHEET NUMBER 7 OF 22

Soil map delineations extending beyond the dashed white quadrangle neeline are for reference only and are included on adjacent map sheets.

Joins sheet 1,
Geary North

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CANADIAN COUNTY, OKLAHOMA
FORT RENO SW QUADRANGLE
SHEET NUMBER 8 OF 22

Joins sheet 2,
Fort Reno NE



Joins sheet 7, Geary South

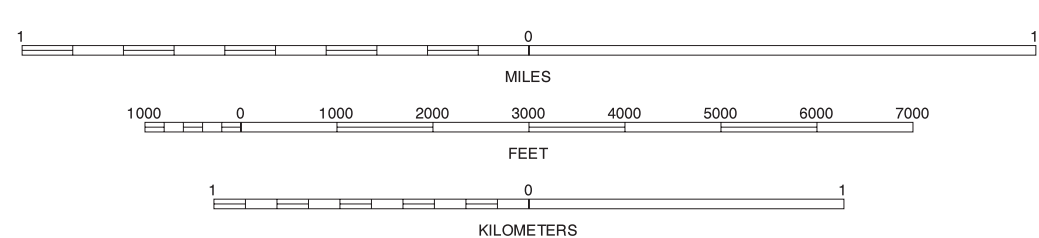
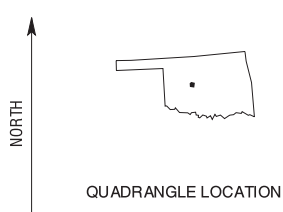
Joins sheet 9, Fort Reno

Joins sheet 13,
Winton

Joins sheet 15,
Cogar NE

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1	2	3
7	8	9
13	14	15

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FORT RENO SW, OKLAHOMA
7.5 MINUTE SERIES
SHEET NUMBER 8 OF 22

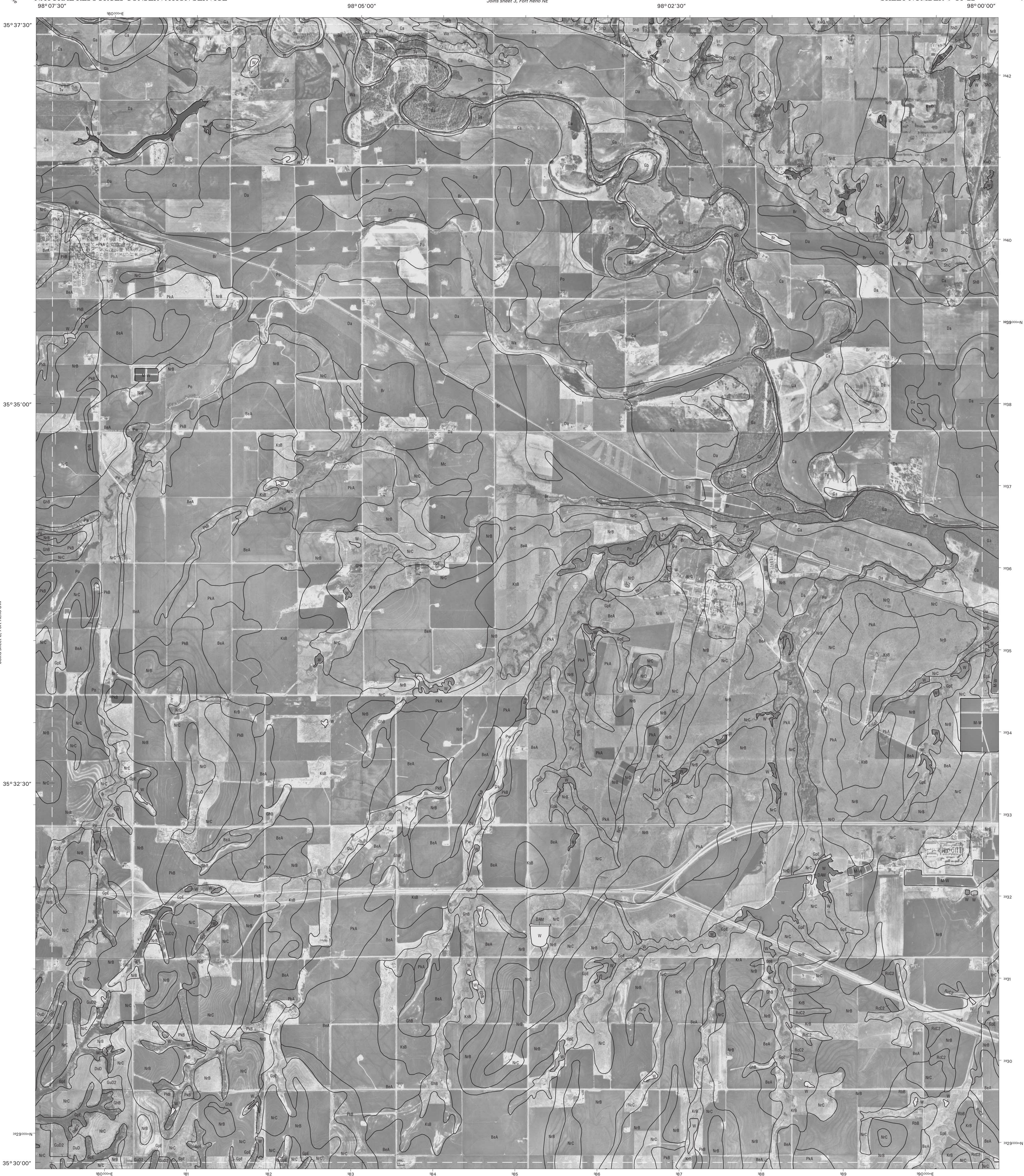
Soil map delineations extending beyond the dashed white quadrangle nealline are for reference only and are included on adjacent map sheets.

Joins sheet 2,
Porcupine Butte

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CANADIAN COUNTY, OKLAHOMA
FORT RENO QUADRANGLE
SHEET NUMBER 9 OF 22

Joins sheet 1,
Okarche



Joins sheet 14,
Cogar NW

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1000-meter ticks: Universal Transverse Mercator, zone 14.
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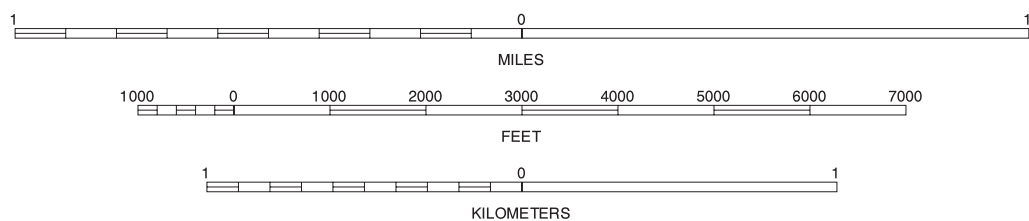
NORTH



QUADRANGLE LOCATION

Joins sheet 15, Cogar NE

SCALE 1:24000



2	3	4	2 PORCUPINE BUTTE
8	10	10	3 FORT RENO NE
14	15	16	4 OKARCHIE
			8 FORT RENO SW
			10 EL RENO
			14 COGAR NW
			15 COGAR NE
			16 UNION CITY

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FORT RENO, OKLAHOMA
7.5 MINUTE SERIES
SHEET NUMBER 9 OF 22

Soil map delineations extending beyond the dashed white quadrangle nealline are for reference only and are included on adjacent map sheets.

Joins sheet 2,
Fort Reno NE

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CANADIAN COUNTY, OKLAHOMA
EL RENO QUADRANGLE
SHEET NUMBER 10 OF 22

Joins sheet 8,
El Reno NE



Joins sheet 3, Fort Reno

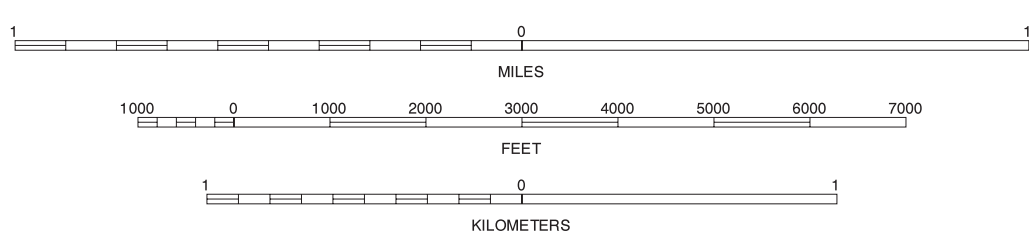
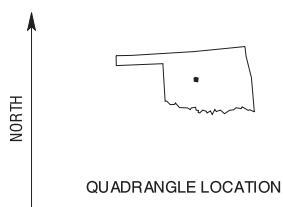
Joins sheet 11, Richland

Joins sheet 15,
Copper NE

Joins sheet 17,
Minco NE

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North American Datum of 1983 (NAD83), GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

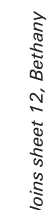


3	4	5	3	4	5
9	10	11	9	10	11
15	16	17	15	16	17

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EL RENO, OKLAHOMA
7.5 MINUTE SERIES
SHEET NUMBER 10 OF 22

Soil map delineations extending beyond the dashed white quadrangle neckline are for reference only and are included on adjacent map sheets.



Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

Joins sheet 5,
El Reno NE

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CANADIAN COUNTY, OKLAHOMA
BETHANY QUADRANGLE
SHEET NUMBER 12 OF 22

97° 42' 30"

Joins sheet 6, Piedmont

97° 40' 00"

97° 37' 30"

35° 37' 30"

35° 35' 00"

35° 32' 30"

35° 30' 00"

Joins sheet 11, Richland

Joins sheet 17,
Minco NE



Joins sheet 18, Mustang

SCALE 1:24000

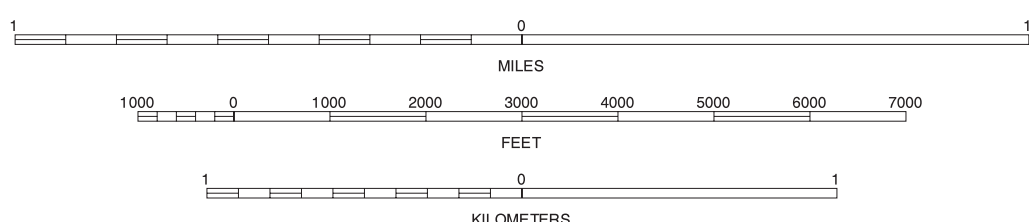
This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1995 aerial photography.

North American Datum of 1983 (NAD83), GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH



QUADRANGLE LOCATION



5	6	5 EL RENO NE 6 PIEDMONT
11		11 RICHLAND
17	18	17 MINCO NE 18 MUSTANG

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BETHANY, OKLAHOMA
7.5 MINUTE SERIES
SHEET NUMBER 12 OF 22

Soil map delineations extending beyond the dashed white quadrangle neartline are for reference only and are included on adjacent map sheets.

5700mE

98° 20' 00"

Joins sheet 7 Geary South

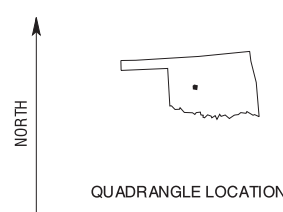
98°17'30"

98°15'00"

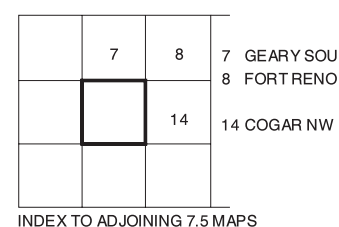
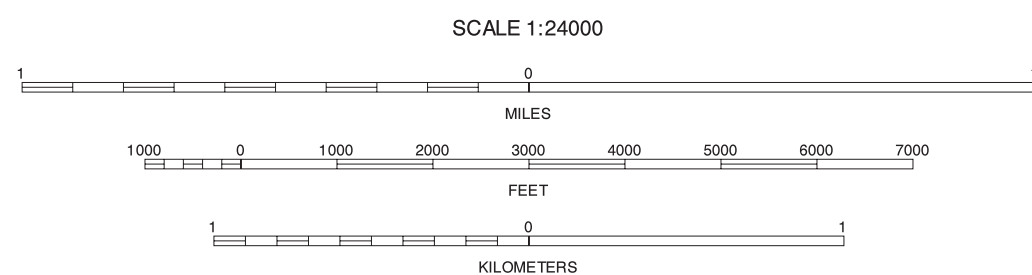
Joins sheet 8,
Fort Reno SW



North American Datum of 1983 (NAD83). GRS-80 Spheroid
1 000-meter ticks: Universal Transverse Mercator, zone 14.
Coordinate grid ticks and land division data, if shown, are
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this quadrangle.



QUADRANGLE LOCATION



SHEET NUMBER 13 OF 22

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

Joins sheet 7,
Geary South

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

Joins sheet 8, Fort Reno SW

CANADIAN COUNTY, OKLAHOMA
COGAR NW QUADRANGLE
SHEET NUMBER 14 OF 22

Joins sheet 9,
Fort Reno

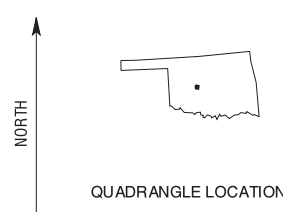


Joins sheet 15, Cogar NE

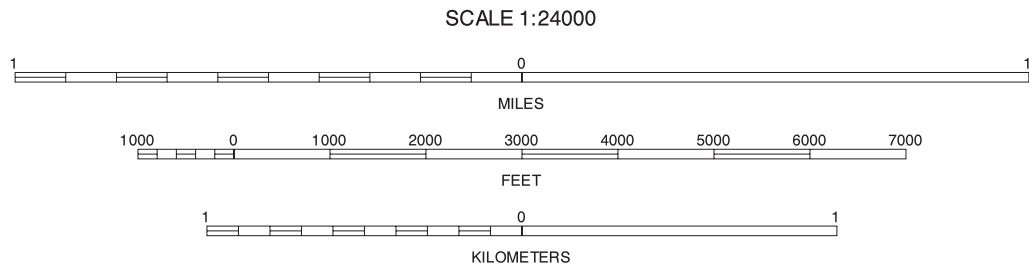
Joins sheet 19,
Cogar SE

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North American Datum of 1983 (NAD83), GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



QUADRANGLE LOCATION

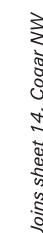


7	8	9
13	14	15
	19	

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COGAR NW, OKLAHOMA
7.5 MINUTE SERIES
SHEET NUMBER 14 OF 22

Soil map delineations extending beyond the dashed white quadrangle neartline are for reference only and are included on adjacent map sheets.



NORTH

Joins sheet 19, Cogar SE

SCALE 1:24000

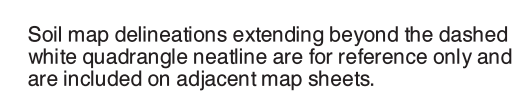
8	9	10	8 FORT RENO SW 9 FORT RENO
14		16	10 EL RENO 14 COGAR NW 16 UNION CITY
	19	20	19 COGAR SE 20 MINCO

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COGAR NE, OKLAHOMA
7.5 MINUTE SERIES
SHEET NUMBER 15 OF 22

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

Joins sheet 2
Minco





North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000-meter ticks: Universal Transverse Mercator, zone 14.
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this quadrangle.

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Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

Joins sheet 11,
Richland

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CANADIAN COUNTY, OKLAHOMA
MUSTANG QUADRANGLE
SHEET NUMBER 18 OF 22

97° 45' 00"

Joins sheet 12, Bethany

97° 40' 00"

97° 37' 30"

35° 30' 00"

35° 27' 30"

35° 25' 00"

35° 22' 30"

3929

3927

3926

3925

3924

3923

3922

3921

3920

3919

3918

3917

3916

Joins sheet 17, Minco NE

Joins sheet 21,
Tuttle

Joins sheet 22, Oklahoma City SW

SCALE 1:24000

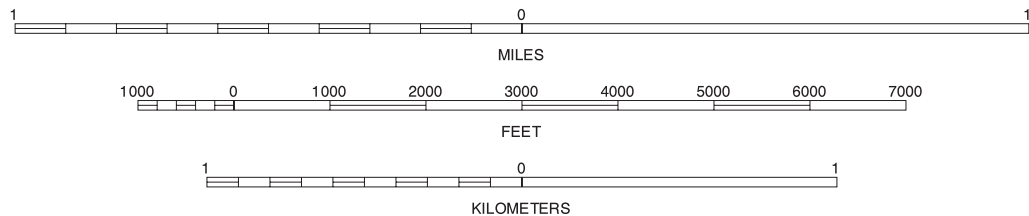
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North American Datum of 1983 (NAD83), GRS-80 Spheroid
1000-meter ticks: Universal Transverse Mercator, zone 14.
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NORTH



QUADRANGLE LOCATION



11	12	11 RICHLAND 12 BETHANY
17		17 MINCO NE
21	22	21 TUTTLE 22 OKLAHOMA CITY SW

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MUSTANG, OKLAHOMA
7.5 MINUTE SERIES
SHEET NUMBER 18 OF 22

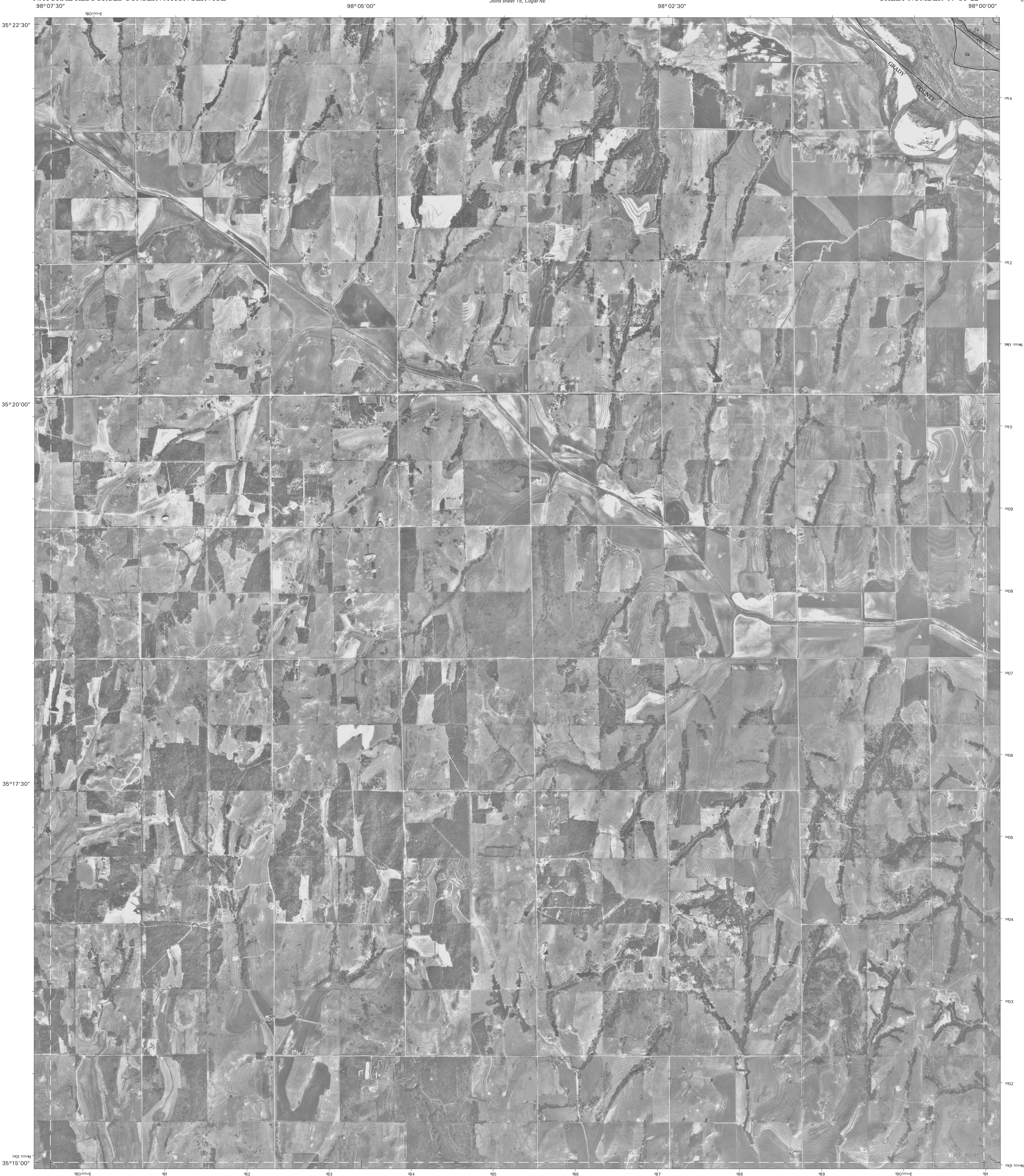
Soil map delineations extending beyond the dashed white quadrangle neartline are for reference only and are included on adjacent map sheets.

Joins sheet 14,
Cogar NW

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CANADIAN COUNTY, OKLAHOMA
COGAR SE QUADRANGLE
SHEET NUMBER 19 OF 22

Joins sheet 16,
Union City



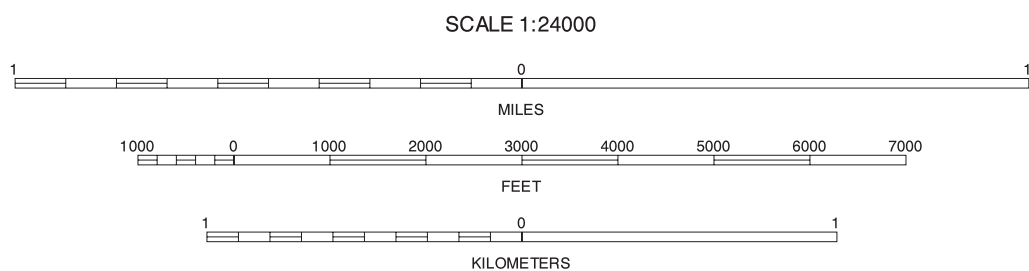
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North American Datum of 1983 (NAD83), GRS-80 Spheroid
1000-meter ticks: Universal Transverse Mercator, zone 14.
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NORTH



QUADRANGLE LOCATION



14	15	16	14 COGAR NW
			15 COGAR NE
			16 UNION CITY
		20	20 MINCO

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COGAR SE, OKLAHOMA
7.5 MINUTE SERIES
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Soil map delineations extending beyond the dashed white quadrangle neartine are for reference only and are included on adjacent map sheets.

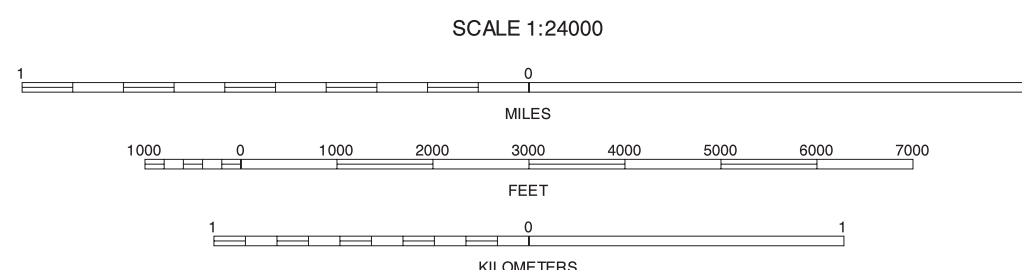


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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 14. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



QUADRANGLE LOCATION



15	16	17	15 COGAR NE 16 UNION CITY 17 MINCO NE 19 COGAR SE 21 TUTTLE
19		21	

INDEX TO ADJOINING 7.5 MAPS

MINCO, OKLAHOMA
7.5 MINUTE SERIES
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Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

Joins sheet 16,
Union City

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

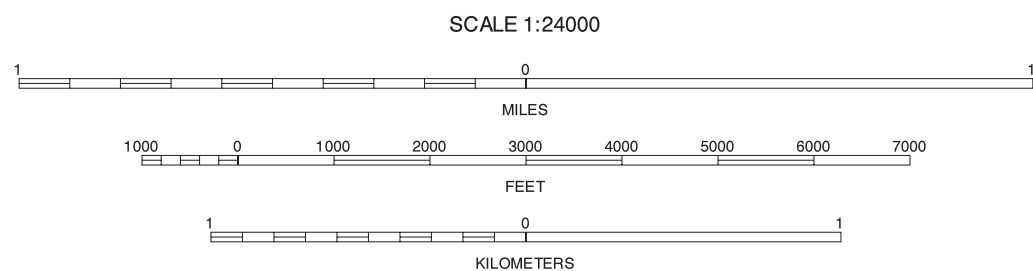
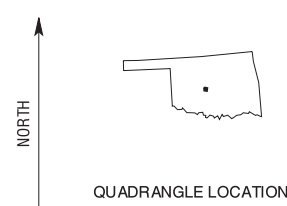
CANADIAN COUNTY, OKLAHOMA
TUTTLE QUADRANGLE
SHEET NUMBER 21 OF 22

Joins sheet 18,
Mustang



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North American Datum of 1983 (NAD83), GRS-80 Spheroid
1000-meter ticks: Universal Transverse Mercator, zone 14.
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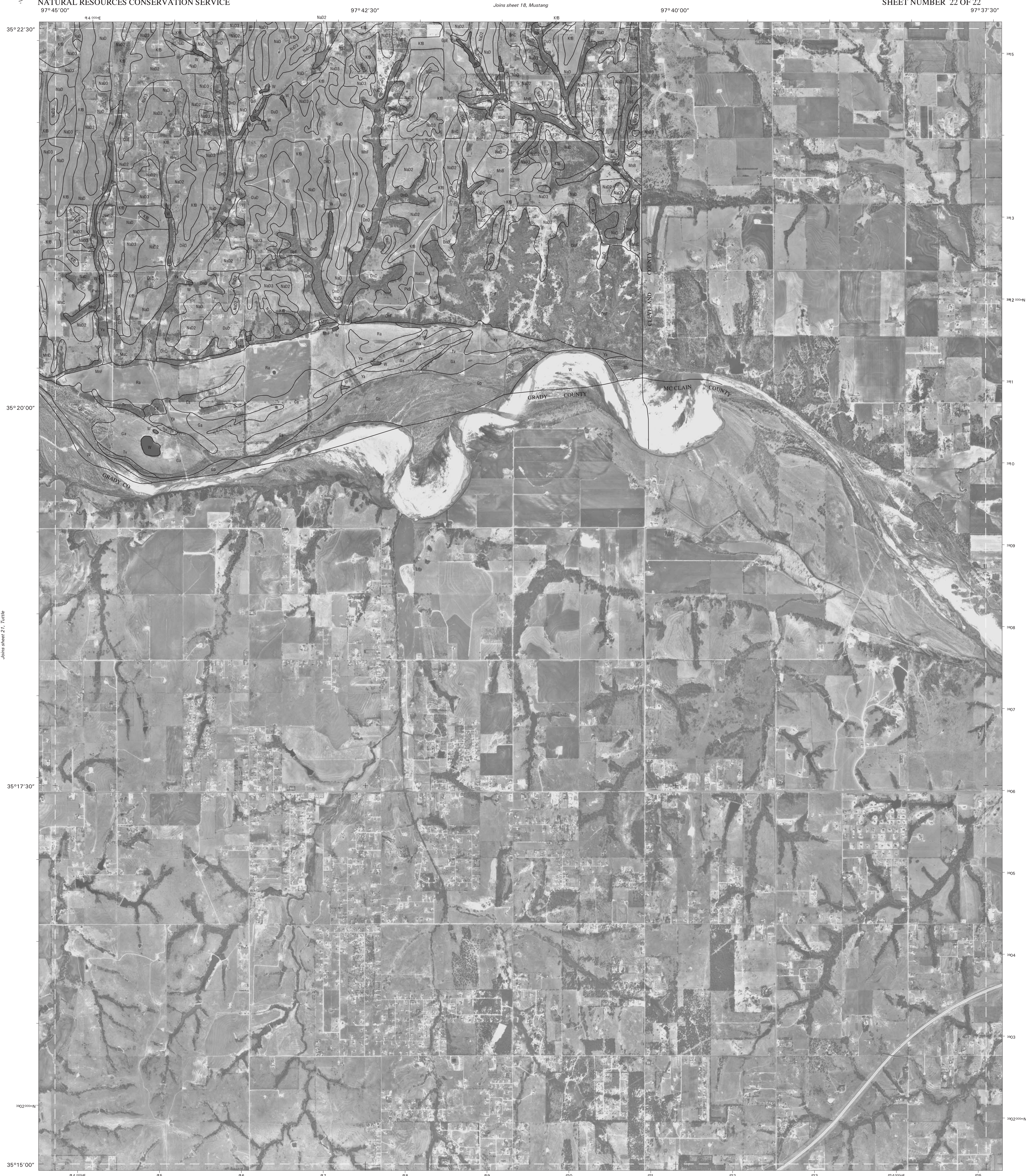


16	17	18	16 UNION CITY
			17 MINCO NE
			18 MUSTANG
			20 MINCO
20	21	22	22 OKLAHOMA CITY SW

INDEX TO ADJOINING 7.5-MINUTE MAPS

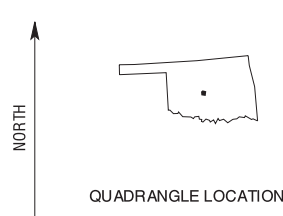
TUTTLE, OKLAHOMA
7.5-MINUTE SERIES
SHEET NUMBER 21 OF 22

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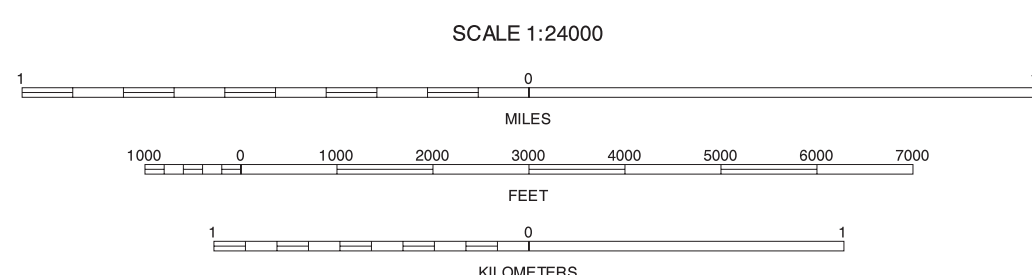


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1000-meter ticks: Universal Transverse Mercator, zone 14.
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this quadrangle.



QUADRANGLE LOCATION



17	18		17 MINCONE 18 MUSTANG
21			21 TUTTLE

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OKLAHOMA CITY SW, OKLAHOMA
7.5 MINUTE SERIES
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